

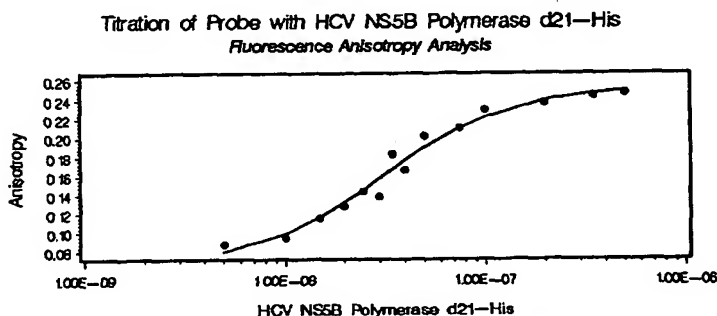
(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
20 February 2003 (20.02.2003)

PCT

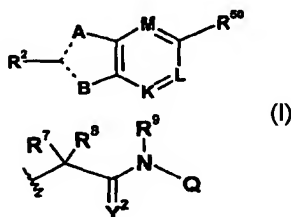
(10) International Publication Number
WO 03/014377 A2

- (51) International Patent Classification⁷: **C12Q 1/00**
- (21) International Application Number: **PCT/CA02/01214**
- (22) International Filing Date: **5 August 2002 (05.08.2002)**
- (25) Filing Language: **English**
- (26) Publication Language: **English**
- (30) Priority Data:
60/310,272 **7 August 2001 (07.08.2001)** **US**
- (71) Applicant (for all designated States except US): **BOEHRINGER INGELHEIM (CANADA) LTD.** [CA/CA]; 2100 Cunard Street, Laval, Québec H7S 2G5 (CA).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **KUKOLJ, George** [CA/CA]; 2100 Cunard Street, Laval, Québec H7S 2G5 (CA). **BEAULIEU, Pierre, L.** [CA/CA]; 2100 Cunard Street, Laval, Québec H7S 2G5 (CA). **MCKERCHER, Ginette** [CA/CA]; 2100 Cunard Street, Laval, Québec H7S 2G5 (CA).
- (74) Agent: **BERNIER, Louise, G.**; 2100 Cunard Street, Laval, Québec H7S 2G5 (CA).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:
— without international search report and to be republished upon receipt of that report

[Continued on next page]

(54) Title: **DIRECT BINDING ASSAY FOR IDENTIFYING INHIBITORS OF HCV POLYMERASE**

Kd = 1.26E-08 r1 = 6.01E-02 r2 = 2.55E-01 Qb/Qf = 0.78 Bkg = 0



(C1-6)alkyl-(C3-7)cycloalkyl, aryl, Het, (C1-6)alkyl-aryl or (C1-6)alkyl-Het, all of which optionally substituted with R90; or R9 is covalently bonded to either of R7 or R8 to form a 5- or 6-membered heterocycle; or a salt thereof; where the probe comprises a detectable label attached to any suitable position, whereby said probe binds to an HCV polymerase or an analog thereof and is capable of being displaced by an inhibitor thereof.

(57) Abstract: A method for identifying compounds binding to HCV polymerase comprising the steps of: contacting said HCV polymerase or an analog thereof with a probe formula I: wherein A is O, S, N, NR1, or CR1, wherein R1 is defined herein; ----- represents either a single or a double bond; R2 is selected from: H, halogen, R21, OR21, SR21, COOR21, SO2N(R22)2, N(R22)2, CON(R22)2, NR22C(O)R22 or NR22C(O)NR22 wherein R21 and each R22 is defined herein; B is NR3 or CR3, wherein R3 is defined herein; with the proviso that, when A is not N, then one of A or B is either CR1 or CR3, K is N or CR4, wherein R4 is defined herein; L is N or CR5, wherein R5 has the same definition as R4 defined above; M is N or CR7, wherein R7 has the same definition as R4 defined above; R5 is C(Y1)Z wherein Y1 is O or S; and Z is N(R6a)R6 or OR6, wherein R6a is H or alkyl or NR61R62 wherein R61 and R62 are defined herein; and R6 is H, alkyl, cycloalkyl, alkenyl, Het, alkyl-aryl, alkyl-Het; or R6 is wherein R7 and R8 and Q are as defined herein; Y2 is O or S; R9 is H, (C1-6)alkyl, (C3-7)cycloalkyl or

WO 03/014377 A2



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

DIRECT BINDING ASSAY FOR IDENTIFYING INHIBITORS OF HCV POLYMERASE

FIELD OF THE INVENTION

5 The present invention relates generally to a method for identifying inhibitors of the HCV RNA dependent RNA polymerase. Particularly, this method uses a novel probe in a competitive assay to identify HCV polymerase inhibitors and determine their potency. More particularly, this invention relates to the use of a probe which binds with specificity to the polymerase, and which is capable of being displaced by
10 inhibitors of the enzyme.

BACKGROUND OF THE INVENTION

Hepatitis C virus (HCV) is the major etiological agent of post-transfusion and community-acquired non-A non-B hepatitis worldwide. It is estimated that over 200
15 million people worldwide are infected by the virus. A high percentage of carriers become chronically infected and many progress to chronic liver disease, so called chronic hepatitis C. This group is in turn at high risk for serious liver disease such as liver cirrhosis, hepatocellular carcinoma and terminal liver disease leading to death. The mechanism by which HCV establishes viral persistence and causes a high rate
20 of chronic liver disease has not been thoroughly elucidated. It is not known how HCV interacts with and evades the host immune system.

HCV is an enveloped positive strand RNA virus in the *Flaviviridae* family. The single strand HCV RNA genome is of positive polarity and comprises one open reading
25 frame (ORF) of approximately 9600 nucleotides in length, which encodes a linear polyprotein of approx. 3010 amino acids. In infected cells, this polyprotein is cleaved at multiple sites by cellular and viral proteases to produce structural and non-structural (NS) proteins. The structural proteins (C, E1, E2 and E2-p7) comprise polypeptides that constitute the virus particle (Hijikata, M. *et al.*, **1991**, Proc. Natl.
30 Acad. Sci. USA. **88**, 5547-5551; Grakoui, A. *et al.*, **1993(a)**, J. Virol. **67**, 1385-1395). The non-structural proteins (NS2, NS3, NS4A, NS4B, NS5A, NS5B) encode for enzymes or accessory factors that catalyze and regulate the replication of the HCV RNA genome. Processing of the structural proteins is catalyzed by host cell proteases (Hijikata *et al.*, **1991**, *supra*). The generation of the mature non-structural
35 proteins is catalyzed by two virally encoded proteases. The first is the NS2/3 zinc-

dependent metalloprotease which auto-catalyses the release of the NS3 protein from the polyprotein. The released NS3 contains a N-terminal serine protease domain (Grakoui A, *et al.*, **1993(b)**, Proc Natl Acad Sci USA, *90*, 10583-7; Hijikata, M. *et al.*, **1993**, J. Virol. *67*, 4665-4675.) and catalyzes the remaining cleavages from the polyprotein. The released NS4A protein has at least two roles. First, forming a stable complex with NS3 protein and assisting in the membrane localization of the NS3/NS4A complex (Kim *et al.*, Arch Virol. **1999**, *144*: 329-343) and second, acting as a cofactor for NS3 protease activity. This membrane-associated complex, in turn catalyzes the cleavage of the remaining sites on the polyprotein, thus effecting the release of NS4B, NS5A and NS5B (Bartenschlager, R. *et al.*, **1993**, J. Virol., *67*, 3835-3844; Grakoui *et al.*, **1993(a) supra**; Hijikata *et al.*, **1993 supra**; Love, R.A. *et al.*, **1996**, Cell, *87*, 331-342; reviewed in Kwong AD. *et al.*, **1998**, Antiviral Res., *40*, 1-18). The C-terminal segment of the NS3 protein also harbors nucleoside triphosphatase and RNA helicase activity (Kim, D.W. *et al.*, **1995**, Biochem. Biophys. Res. Comm., *215*, 160-166). The function of the protein NS4B is unknown. NS5A, a highly phosphorylated protein, seems to be responsible for the Interferon resistance of various HCV genotypes (Gale Jr. *et al.* **1997** Virology *230*, 217; Reed *et al.*, **1997**, J. Virol. *71*, 7187). NS5B is an RNA-dependent RNA polymerase (RdRp) that is involved in the replication of HCV.

20

To better understand the mechanism of HCV RNA replication and to develop appropriate *in vitro* systems, biochemical analyses of the NS5B protein have been performed. Full-length NS5B has been produced and purified as a non-fusion protein from insect cells infected with recombinant baculovirus (S.-E. Behrens *et al.*, **1996**, EMBO J., *15*:12-22; R. de Francesco *et al.*, **1996**, Methods Enzymol., *275*:58-67) or as a tagged protein from both insect cells (V. Lohmann *et al.*, **1997**, J. Virol., *71*:8416-8428; V. Lohmann *et al.*, **1998**, Virology *249*:108-118) and E. coli (Z.-H. Yuan *et al.*, **1997**, BBRC *232*:231-235). *In vitro*, the RdRp activity of recombinant NS5B is dependent on an RNA template and requires RNA or DNA as a primer (S.-E. Behrens *et al.*, **1996**, EMBO J. *15*:12-22; V. Lohmann *et al.*, **1997**, J. Virol., *71*:8416-8428). On RNA templates of heteropolymeric sequences, the 3'-OH of the template is used as a primer and elongation proceeds via a "snap-back" mechanism, leading to a double-stranded molecule in which template and product RNA are covalently linked (S.-E. Behrens *et al.*, **1996**, EMBO J., *15*:12-22; V. Lohman *et al.*, **1998**, Virology, *249*:108-118; G. Luo *et al.*, **2000**, J. Virol. *74*:851-863). Recently,

35

several groups also demonstrated that the HCV NS5B protein is able to initiate RNA synthesis *de novo* (J. Oh *et al.*, 1999, J. Virol. 73:7694-7702; X. Sun *et al.*, 2000, BBRC 268:798-803; W. Zhong *et al.*, 2000, J. Virol. 74:2017-2022).

5 The NS5B RdRp has been crystallized to reveal a structure reminiscent of other nucleic acid polymerases (S. Bressanelli *et al.*, 1999, PNAS USA 96:13034-13039; H. Ago *et al.*, 1999, Structure 7:1417-1426; C.A. Lesburg *et al.*, 1999, Nature Struct. Biol., 6:937-943). A comprehensive understanding of the differences between HCV and cellular polymerases will facilitate the design of specific inhibitors of HCV
10 replication. Detailed kinetic information will also help in understanding the molecular basis of HCV NS5B-catalyzed nucleotide incorporation and subsequently the mechanistic characterization of the inhibitors.

Previous studies (S.-E. Behrens *et al.*, 1996, EMBO J. 15:12-22; R. de Francesco *et al.*, 1996, Methods Enzymol. 275:58-67; V. Lohmann *et al.*, 1997, J. Virol. 71:8416-8428; V. Lohmann *et al.*, 1998, Virology 249:108-118) provided little information with regard to the proportion of the polymerase RNA complexes that are competent for catalysis. Some recent studies investigated the template and primer requirements for HCV NS5B-directed RNA replication. Templates with 3'-termini free of secondary
20 structures and short primers 2 or 3 nucleotides (nt) long were preferred for efficient initiation of RNA synthesis (W. Zhong *et al.*, 2000, J. Virol. 74:9134-9143). In *de novo* initiation of RNA synthesis, however, NS5B needs a template with a stable secondary structure and a single-stranded sequence that contains at least one 3'-cytidylate.

25 Viral polymerases represent attractive targets for therapeutic inhibition of viral replication. The discovery of new antiviral agents often involves screening of large numbers of samples for inhibition of the target activity using either *in vitro* or *in vivo* assays. In general, polymerases are assayed by monitoring the incorporation of
30 either ^3H -, α - ^{32}P or α - ^{33}P -labeled mononucleotides into oligonucleotide products, or by the extension of 5'-end-labeled primers. Products incorporated into the extended primers are captured or separated using common filter assays, acid precipitation, or denaturing gel electrophoresis.

35 The HCV NS5B polymerase is a prime target in the search for inhibitors of HCV

replication. Different preparations of the HCV polymerase exhibit varying efficiencies of product formation with a variety of RNA substrates. Moreover, the activity of purified recombinant NS5B polymerase varies significantly with specific RNA substrates. In addition, the *in vitro* RNA polymerase activity of NS5B is extremely sensitive to ionic strength, and salt concentrations exceeding 100 mM inhibit the reaction. Hence the ability to determine the potency of inhibitors at various salt concentrations is restricted by this limitation of standard enzymatic reactions. Also, HCV polymerase enzymatic assays disclosed in the prior art provide IC₅₀ values as representative measurements of inhibitor potencies. For inhibitors that are competitive with either RNA or NTP, the IC₅₀ value is proportional to the concentration of substrates in the assay and will vary depending on the concentration of these components.

In an effort to overcome the limitations of HCV polymerase assays that use sub-optimal and poorly characterized RNA substrates, the Applicants have developed an assay for identifying specific inhibitors of the HCV polymerase that is independent of RNA.

It is therefore an advantage of the present invention to provide an assay that permits a direct measurement of inhibitor potencies (reflected by K_d values as an unequivocal determination of inhibitor potency) under defined conditions, irrespective of the substrate concentration.

The direct binding assay of this invention is amenable to adjustments in salt concentration or pH levels beyond the restricted range required for RNA polymerization. This type of assay is amenable to a high sensitivity and a high throughput format.

It is a further advantage of the present invention to provide a probe that binds to the polymerase with a high affinity, and which is displaced by inhibitors of the enzyme.

It is a further advantage to provide an assay that is applicable to HCV polymerases of different genotypes.

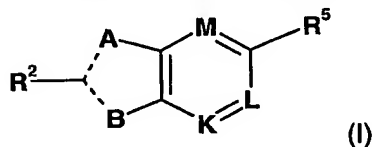
SUMMARY OF THE INVENTION

In a first aspect of the invention, there is provided a method for identifying compounds binding to HCV polymerase comprising the steps of:

- a) contacting said HCV polymerase or an analog thereof with a probe being capable of binding to an HCV polymerase or an analog thereof, said probe being displaceable by an inhibitor thereof, so as to form a complex comprising said probe bound to said polymerase;
- b) measuring a signal emitted from said probe in said complex to establish a base line level;
- c) incubating the product of step a) with a test compound; and
- d) measuring the signal from said complex; and
- e) comparing the signal from step d) with the signal from step b);

whereby a modulation in said signal is an indication that said test compound binds to said polymerase.

In a preferred aspect the first embodiment, the probe is selected from: an isomer, enantiomer, diastereoisomer, or tautomer of a probe represented by formula I:



wherein:

- A is O, S, N, NR¹, or CR¹, wherein R¹ is selected from the group consisting of: H, (C₁₋₆)alkyl optionally substituted with:
 - halogen, OR¹¹, SR¹¹ or N(R¹²)₂, wherein R¹¹ and each R¹² is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-Het, said aryl or Het optionally substituted with R¹⁰; or
- both R¹² are covalently bonded together and to the nitrogen to which they are both attached to form a 5, 6 or 7-membered saturated heterocycle;

----- represents either a single or a double bond;

- R² is selected from: H, halogen, R²¹, OR²¹, SR²¹, COOR²¹, SO₂N(R²²)₂, N(R²²)₂, CON(R²²)₂, NR²²C(O)R²² or NR²²C(O)NR²² wherein R²¹ and each R²² is independently H, (C₁₋₆)alkyl, haloalkyl, (C₂₋₆)alkenyl, (C₃₋₇)cycloalkyl, (C₂₋₆)alkynyl, (C₅₋

₇)cycloalkenyl, 6 or 10-membered aryl or **Het**, said R^{21} and R^{22} being optionally substituted with R^{20} ;
 or both R^{22} are bonded together to form a 5, 6 or 7-membered saturated heterocycle with the nitrogen to which they are attached;

5

B is NR^3 or CR^3 , wherein R^3 is selected from (C₁₋₆)alkyl, haloalkyl, (C₃₋₇)cycloalkyl, (C₆₋₁₀)bicycloalkyl, 6- or 10-membered aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**, said alkyl, cycloalkyl, bicycloalkyl, aryl, **Het**, alkyl-aryl and alkyl-**Het** being optionally substituted with from 1 to 4 substituents selected from: halogen, or

10

a) (C₁₋₆)alkyl optionally substituted with:

- OR^{31} or SR^{31} wherein R^{31} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**; or

15

- $N(R^{32})_2$ wherein each R^{32} is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**; or both R^{32} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

20

b) OR^{33} wherein R^{33} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or

(C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**;

c) SR^{34} wherein R^{34} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or

(C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**;

and

25

d) $N(R^{35})_2$ wherein each R^{35} is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**; or both R^{35} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

with the proviso that, when **A** is not N, then one of **A** or **B** is either CR^1 or CR^3 ;

30

K is N or CR^4 , wherein R^4 is H, halogen, (C₁₋₆)alkyl, haloalkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl; or R^4 is OR^{41} or SR^{41} , COR^{41} or $NR^{41}COR^{41}$ wherein each R^{41} is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl; or R^4 is $NR^{42}R^{43}$ wherein R^{42} and R^{43} are each independently H, (C₁₋₆)alkyl, (C₃₋

$_7$ cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, or both R^{42} and R^{43} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

5 L is N or CR^5 , wherein R^5 has the same definition as R^4 defined above;

M is N or CR^7 , wherein R^7 has the same definition as R^4 defined above;

R^5 is C(Y^1)-Z wherein Y^1 is O or S;

10

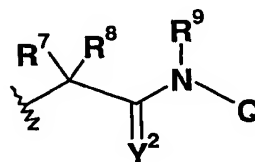
Z is N(R^{6a}) R^6 or OR^6 , wherein R^{6a} is H or (C₁₋₆)alkyl or $NR^{61}R^{62}$ wherein R^{61} and R^{62} are each independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, or both R^{61} and R^{62} are covalently bonded together and to the nitrogen to which they are both attached to form a 5, 6 or 7-membered

15

saturated heterocycle; or R^{62} is $COOR^{63}$ wherein R^{63} is (C₁₋₆)alkyl, (C₃₋₆)cycloalkyl, said alkyl or cycloalkyl being optionally substituted with 6- or 10-membered aryl or **Het**; or R^{62} is COR^{64} wherein R^{64} is (C₁₋₆)alkyl, (C₃₋₆)cycloalkyl -6- or 10-membered aryl or **Het**; and

20 R^6 is selected from the group consisting of: H, (C₁₋₆)alkyl, (C₃₋₆)cycloalkyl, (C₂₋₆)alkenyl, 6- or 10-membered aryl, **Het**, (C₁₋₆)alkyl-aryl, (C₁₋₆)alkyl-**Het**, wherein said alkyl, cycloalkyl, alkenyl, aryl, **Het**, alkyl-aryl, or alkyl-**Het**, are all optionally substituted with R^{60} ;

25 or R^6 is



wherein R^7 and R^8 are each independently H, (C₁₋₆)alkyl, haloalkyl, (C₃₋₇)cycloalkyl, 6- or 10-membered aryl, **Het**, (C₁₋₆)alkyl-aryl, (C₁₋₆)alkyl-**Het**, wherein said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl, (C₁₋₆)alkyl-**Het** are optionally substituted with R^{70} ;

30 or

R^7 and R^8 are covalently bonded together to form second (C₃₋₇)cycloalkyl or a 4, 5- or

6-membered heterocycle having from 1 to 4 heteroatom selected from O, N, and S;
or when **Z** is $N(R^{6a})R^6$, either of R^7 or R^8 is covalently bonded to R^{6a} to form a
nitrogen-containing 5- or 6-membered heterocycle;

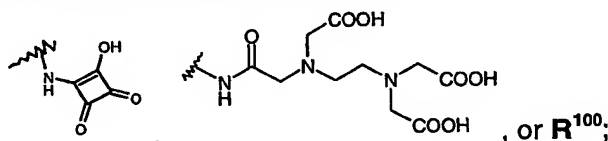
5 Y^2 is O or S;

R^9 is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl-
aryl or (C_{1-6}) alkyl-**Het**, all of which optionally substituted with R^{90} ; or

R^9 is covalently bonded to either of R^7 or R^8 to form a 5- or 6-membered heterocycle;

10

Q is a 6- or 10-membered aryl, **Het**, (C_{1-6}) alkyl-CONH-aryl or (C_{1-6}) alkyl-CONH-**Het**,
all of which being optionally substituted with:



or a salt or a derivative thereof;

15

wherein **Het** is defined as 5- or 6-membered heterocycle having 1 to 4 heteroatoms
selected from O, N, and S, or a 9- or 10-membered heterobicyclic having 1 to 4
heteroatoms selected from O, N and S; and

20 R^{10} , R^{20} , R^{60} , R^{70} , R^{80} and R^{100} is each defined as:

- 1 to 4 substituents selected from: halogen, OPO_3H , NO_2 , cyano, azido,
 $C(=NH)NH_2$, $C(=NH)NH(C_{1-6})$ alkyl or $C(=NH)NHCO(C_{1-6})$ alkyl; or

- 1 to 4 substituents selected from:

25 a) (C_{1-6}) alkyl or haloalkyl, (C_{3-7}) cycloalkyl, C_{3-7} spirocycloalkyl optionally
containing 1 or 2 heteroatom, (C_{2-6}) alkenyl, (C_{2-8}) alkynyl, (C_{1-6}) alkyl- (C_{3-7})
cycloalkyl, all of which optionally substituted with R^{150} ;

b) OR^{104} wherein R^{104} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7})
cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl) aryl or (C_{1-6}) alkyl) **Het**, said alkyl, cycloalkyl,
aryl, **Het**, (C_{1-6}) alkyl) aryl or (C_{1-6}) alkyl) **Het** being optionally substituted with
30 R^{150} ;

c) $OCOR^{105}$ wherein R^{105} is (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7})
cycloalkyl, **Het**, (C_{1-6}) alkyl) aryl or (C_{1-6}) alkyl) **Het**, said alkyl, cycloalkyl, aryl,

Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

d) SR¹⁰⁸, SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both R¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁵⁰;

e) NR¹¹¹R¹¹² wherein R¹¹¹ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and R¹¹² is H, CN, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with R¹⁵⁰;

f) NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

g) NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁵⁰;

h) NR¹²¹COCOR¹²² wherein R¹²¹ and R¹²² is each is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰; or R¹²² is OR¹²³ or N(R¹²⁴)₂ wherein R¹²³ and each R¹²⁴ is independently H,

- (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹²⁴ is OH or O(C₁₋₆alkyl) or both R¹²⁴ are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;
- 5 **i)** COR¹²⁷ wherein R¹²⁷ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;
- j)** COOR¹²⁸ wherein R¹²⁸ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;
- 10 **k)** CONR¹²⁹R¹³⁰ wherein R¹²⁹ and R¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;
- 15 **l)** aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with R¹⁵⁰; and
- 20 wherein R¹⁵⁰ is defined as: - 1 to 3 substituents selected from:
 halogen, OPO₃H, NO₂, cyano, azido, C(=NH)NH₂, C(=NH)NH(C₁₋₆alkyl) or C(=NH)NHCO(C₁₋₆alkyl); or
 - 1 to 3 substituents selected from:
- 25 **a)** (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁶⁰;
- b)** OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁶⁰;
- 30 **c)** OCOR¹⁰⁵ wherein R¹⁰⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted

with R^{160} ;

d) SR^{108} , SO_3H , $SO_2N(R^{108})_2$ or $SO_2N(R^{108})C(O)R^{108}$ wherein each R^{108} is independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het or both R^{108} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het or heterocycle being optionally substituted with R^{160} ;

e) $NR^{111}R^{112}$ wherein R^{111} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het, and R^{112} is H, CN, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl, (C_{1-6}) alkyl)Het, $COOR^{115}$ or SO_2R^{115} wherein R^{115} is (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het, or both R^{111} and R^{112} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het, or heterocycle being optionally substituted with R^{160} ;

f) $NR^{116}COR^{117}$ wherein R^{116} and R^{117} is each H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het, said (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het being optionally substituted with R^{160} ;

g) $NR^{118}CONR^{119}R^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het, or R^{118} is covalently bonded to R^{119} and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

said alkyl, cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het or heterocycle being optionally substituted with R^{160} ;

12

h) $\text{NR}^{121}\text{COCOR}^{122}$ wherein R^{121} and R^{122} is each is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, a 6- or 10-membered aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** being optionally substituted with R^{160} ;

or R^{122} is OR^{123} or $\text{N}(\text{R}^{124})_2$ wherein R^{123} and each R^{124} is independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, or R^{124} is OH or $\text{O}(\text{C}_{1-6})$ alkyl) or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** and heterocycle being optionally substituted with R^{160} ;

i) COR^{127} wherein R^{127} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** being optionally substituted with R^{160} ;

j) tetrazole, COOR^{128} wherein R^{128} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, said (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl and (C_{1-6}) alkyl)**Het** being optionally substituted with R^{160} ; and

k) $\text{CONR}^{129}\text{R}^{130}$ wherein R^{129} and R^{130} are independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl, (C_{1-6}) alkyl)**Het** and heterocycle being optionally substituted with R^{160} ;

wherein R^{160} is defined as 1 or 2 substituents selected from: tetrazole, halogen, CN, C_{1-6} alkyl, haloalkyl, COOR^{161} , SO_3H , SR^{161} , $\text{SO}_2\text{R}^{161}$, OR^{161} , $\text{N}(\text{R}^{162})_2$, $\text{SO}_2\text{N}(\text{R}^{162})_2$, or $\text{CON}(\text{R}^{162})_2$, wherein R^{161} and each R^{162} is independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl; or both R^{162} are covalently bonded together and to the nitrogen to which they

are attached to form a 5, 6 or 7-membered saturated heterocycle,

wherein said probe comprises a detectable label attached to any suitable position, whereby said probe binds to an HCV polymerase or an analog thereof and is capable of being displaced by an inhibitor thereof.

According to an alternative of this first embodiment, the probe used for the assay does not comprise a detectable label, and the signal measured is the change in intrinsic fluorescence of the HCV polymerase in the presence and absence of said probe.

According to a second aspect of the invention, there is provided the use of a probe according to formula I in the development of an assay for identifying inhibitors of HCV polymerase.

According to a third aspect of the invention, there is provided a kit for testing compounds potentially binding to HCV polymerase, said kit comprising the probe of formula (I) and instructions on how to use said probe for identifying test compounds binding to said polymerase.

BRIEF DESCRIPTION OF THE FIGURES

Having thus generally described the invention, reference will now be made to the accompanying drawings, showing by way of illustration a preferred embodiment thereof, and in which:

Figure 1 illustrates the titration of probe (i) with the NS5B Δ 21-His polymerase. Standard conditions for the Fluorescence anisotropy analysis are described in Example 3. The determined K_d value of probe (i) for this polymerase is 12.6 nM.

Figure 2 illustrates Z' evaluation for the Fluorescence Polarization assay. A series of positive and negative controls were tested in the 96-well plate polarization assay, using the standard conditions, to determine the standard deviation (SD) of both controls. The Z' value was then obtained from the following calculation :

$$Z' = \frac{1 - (3 \text{ SD of pos. ctrls} + 3 \text{ SD of neg. ctrls})}{(\text{mean pos. ctrl} - \text{mean neg. ctrl})}$$

- Figure 3** illustrates K_d determination for Compounds A and B, using the
5 Fluorescence Polarization assay. Standard conditions of the 96-well plate Polarization assay (see Example 4) were used to determine the K_d values of the compounds. K_d values obtained for compound A and B are 31 and 41 nM, respectively, with Q_b/Q_f values of 0.67 and 0.72.
- 10 **Figure 4** illustrates K_d determination for Compounds C and D, using the Fluorescence Polarization assay. Standard conditions of the 96-well plate Polarization assay (see Example 4) have been used to determine the K_d values of some of our compounds. K_d values obtained for compound C and D are 231 nM and 1.08 μ M, respectively, with Q_b/Q_f values of 0.74 and 0.66.
- 15 **Figures 5 to 8** illustrate the titration of probe (i) with the NS5B Δ 21-His in the presence of increasing (from 30 mM to 200 mM) concentration of NaCl. Standard conditions of the Fluorescence anisotropy analysis are described in Example 3. K_d values obtained for this polymerase are 15.3 nM (30 mM NaCl), 39
20 nM (100 mM NaCl), 78 nM (150 mM NaCl) and finally 122 nM (200 mM NaCl).
- Figure 9** illustrates the titration of probe (i) with the NS5B Δ 21-His in Phosphate buffer pH 6.5. Standard conditions of the Fluorescence anisotropy analysis are described in Example 3. The K_d of probe (i) for this polymerase under these
25 conditions is 33 nM.
- Figure 10** illustrates the titration of probe (i) with the His-NS5B Δ 21 polymerase. Standard conditions of the Fluorescence anisotropy analysis are described in Example 3. The K_d of probe (i) for this N-terminally tagged polymerase is 18.1 nM.
30
- Figure 11** illustrates the titration of probe (ii) with the GBV-B Δ 23-His polymerase. Standard conditions of the Fluorescence anisotropy analysis are described in Example 3. The K_d of probe (ii) for this distantly related polymerase is 1.79 μ M (estimated value with an incomplete curve).
35

Figure 12 illustrates the titration of probe (ii) with the His-NS5B Δ 21(H77c, HCV genotype 1a) polymerase. Standard conditions of the Fluorescence anisotropy analysis are described in Example 3. The K_d of probe (ii) for this HCV genotype 1a polymerase is 18.2 nM.

5

DETAILED DESCRIPTION OF THE INVENTION

Definitions

The following definitions apply unless otherwise noted:

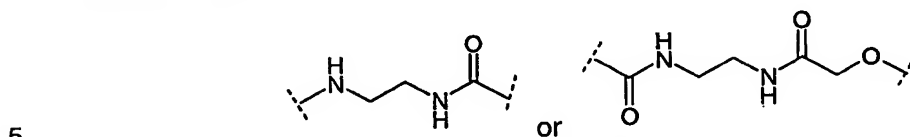
- 10 The term "affinity tag" means a moiety whose strong affinity for a ligand can be used to extract from a solution the entity to which the tag is attached. Examples of such tags include biotin or a derivative thereof, a histidine polypeptide, a polyarginine, an amylose sugar moiety or a defined epitope recognizable by a specific antibody. Such affinity tags are attached to the probe by well-known methods. The corresponding
- 15 affinity ligands are also well known in the art.

- An "analog" of the HCV NS5B polypeptide or a fragment thereof means a polypeptide modified by varying the amino acid sequence of the protein, e.g. by manipulation of the nucleic acid encoding the protein or by altering the protein itself.
- 20 Such analogs of the natural amino acid sequence may involve insertion, addition, deletion or substitution of one or more amino acids, and may or may not alter the functional activity of the original HCV NS5B polypeptide. As mentioned above, the HCV NS5B polypeptide or protein used in the assay/method of the invention includes any fragment, derivative, variant or mutant which is derived from a HCV
- 25 NS5B polypeptide and which retains at least one property or other characteristic of the HCV NS5B polypeptide.

- The term "detectable label" refers to any group that is linked to a probe of the present invention such that when the probe is associated with the polymerase target,
- 30 such label allows recognition either directly or indirectly of the probe such that it can be detected, measured and quantified. Examples of such "detectable labels" are intended to include, but are not limited to: photoreactive groups, fluorescent labels, chemiluminescent labels, colorimetric labels, enzymatic markers, radioactive isotopes. Such labels are attached to the probe by well known methods.

35

As used herein, the term "linker" refers to a chain of between 1 and 20 atoms selected from the group consisting of C, N, O, and S that covalently connects the aforesaid label to a probe of the present invention. Examples of such a chain include, but are not limited to, the following:



These linkers can also comprise a pair of affinity-tag/affinity-ligand, which together, bind the compound to a detectable label.

10 The term "photoreactive group" means a group that is transformed, upon activation by light, from an inert group to a reactive species, such as a free radical. Examples of such groups include, but are not limited to, benzophenones, azides, and the like.

As used herein, the term "probe" refer to a compound of formula (I) that is capable of binding to an HCV polymerase in a covalent or non-covalent manner. When the
15 probe is bound in a non-covalent manner, it can be displaced by a test compounds. When bound in a covalent manner, the probe can be used for cross-linking experiments wherein the HCV polymerase-probe adduct formation can be quantified and inhibited by test compounds.

20 As used herein, the terms "(C₁₋₃) alkyl", "(C₁₋₄) alkyl" or "(C₁₋₆) alkyl", either alone or in combination with another radical, are intended to mean acyclic straight or branched chain alkyl radicals containing up to three, four and six carbon atoms respectively. Examples of such radicals include methyl, ethyl, propyl, butyl, hexyl, 1-methylethyl, 1-methylpropyl, 2-methylpropyl, 1,1-dimethylethyl.

25'

As used herein, the term "(C₂₋₆) alkenyl", either alone or in combination with another radical, is intended to mean an unsaturated, acyclic straight chain radical containing two to six carbon atoms.

30 As used herein, the term "(C₂₋₆) alkynyl" either alone or in combination with another group, is intended to mean an unsaturated, acyclic straight chain sp hybridized radical containing 2 to six carbon atoms.

As used herein, the term "(C₃₋₇) cycloalkyl", either alone or in combination with another radical, means a cycloalkyl radical containing from three to seven carbon atoms and includes cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl and cycloheptyl.

- 5 As used herein, the term "(C₅₋₇)cycloalkenyl", either alone or in combination with another radical, means an unsaturated cyclic radical containing five to seven carbon atoms.

- 10 As used herein, the term "aryl", or "6- or 10-membered aryl" either alone or in combination with another radical means aromatic radical containing six or ten carbon atoms, for example phenyl or naphthyl.

- 15 As used herein, the term "COOH" refers to a carboxylic acid group. It is well known to one skilled in the art that carboxylic acid groups may be substituted by functional group equivalents. Examples of such functional group equivalents that are contemplated by this invention include, but are not limited to, esters, amides, or boronic acids.

- 20 As used herein, the term "functional group equivalent" is intended to mean an element or a substituted derivative thereof, that is replaceable by another element that has similar electronic, hybridization or bonding properties.

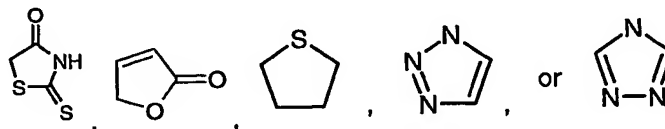
- 25 As used herein, the term "halo" means a halogen atom and includes fluorine, chlorine, bromine and iodine.

As used herein, the term "haloalkyl" is intended to mean an alkyl that is described above in which each hydrogen atom may be successively replaced by a halogen atom, for example CH₂Br or CF₃.

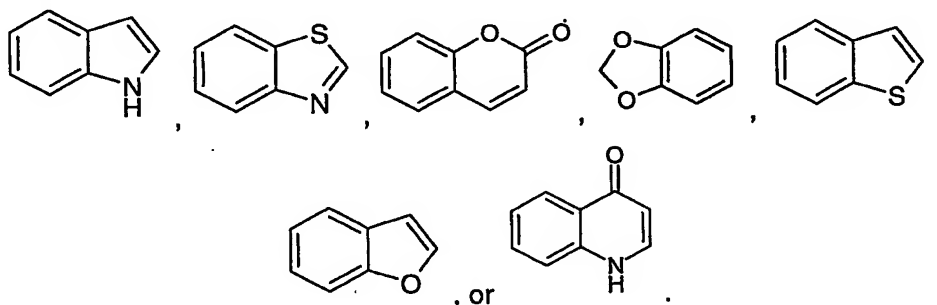
- 30 As used herein the term heteroatom means O, S or N.

- 35 As used herein, the term "heterocycle", either alone or in combination with another radical, means a monovalent radical derived by removal of a hydrogen from a five-, six-, or seven-membered saturated or unsaturated (including aromatic) heterocycle containing from one to four heteroatoms selected from nitrogen, oxygen and sulfur.

Furthermore, "heterobicyclic" as used herein, means a heterocycle as defined above fused to one or more other cycle, be it a heterocycle or any other cycle. Examples of such heterocycles include, but are not limited to, pyrrolidine, tetrahydrofuran, thiazolidine, pyrrole, thiophene, coumarin, hydantoin, diazepine, 1H-imidazole, isoxazole, thiazole, tetrazole, piperidine, 1,4-dioxane, 4-morpholine, pyridine, pyridine-N-oxide, pyrimidine, thiazolo[4,5-b]-pyridine, quinoline, or indole, or the following heterocycles:



As used herein, the term "9- or 10-membered heterobicyclic" or "heterobicyclic" either alone or in combination with another radical, means a heterocycle as defined above fused to one or more other cycle, be it a heterocycle or any other cycle. Examples of such heterobicyclics include, but are not limited to, thiazolo[4,5-b]-pyridine, quinoline, or indole, or the following:



As used herein, the term "Het" defines a 5- or 6-membered heterocycle having 1 to 4 heteroatoms selected from O, N, and S, or a 9- or 10-membered heterobicyclic having 1 to 4 heteroatoms selected from O, N and S.

As used herein, the term "OH" refers to a hydroxyl group. It is well known to one skilled in the art that hydroxyl groups may be substituted by functional group equivalents. Examples of such functional group equivalents that are contemplated by this invention include, but are not limited to, ethers, sulfhydryls, and primary, secondary or tertiary amines.

As used herein, the term "SH" refers to a sulfhydryl group. It is intended within the scope of the present invention that, whenever a "SH" or "SR" group is present, it can also be substituted by any other appropriate oxidation state such as SOR, SO₂R, or SO₃R.

5

It is intended that the term "substituted" when applied in conjunction with a radical having more than one moiety such as C₁₋₆alkyl-aryl, or C₁₋₆alkyl-Het, such substitution applies to both moieties i.e. both the alkyl and aryl or Het moieties can be substituted with the defined substituents.

10

Description of preferred embodiments

Preferably, according to the first aspect, the invention provide a method for identifying inhibitors of HCV polymerase comprising the steps of:

15

- a) contacting said HCV polymerase with a probe of formula I so as to form a complex comprising said probe bound to said polymerase;
- b) measuring a signal from said complex to establish a base line level;
- c) incubating the product of step a) with a test compound;
- d) measuring the signal from said complex; and

20

- e) comparing the signal from step d) with the signal from step b);

whereby a decrease in said signal is an indication that said test compound is an inhibitor of said polymerase.

25

As will be understood by a person skilled in the art, the association of a specific probe of the invention with the NS5B polymerase can be measured directly or indirectly in a variety of ways. The probe and NS5B polymerase need not be labeled and affinity tagged respectively. The association of a specific probe with the HCV NS5B polymerase can be monitored and quantified directly by a change in the intrinsic spectral properties of a tagged or un-tagged NS5B protein and/or by a

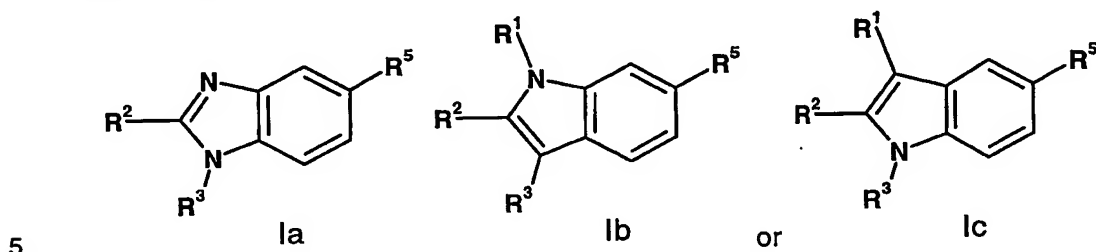
change in the intrinsic spectral properties of a specific probe. A direct measurement of inhibitor-NS5B association can also be achieved by immobilizing one of these two components on a matrix and measuring association through plasma-resonance detection technology. An assay that quantifies probe-NS5B complex association may also incorporate a photo-reactive label (such as a phenyl-azide or benzophenone)

on the probe (for example probes (v) and (vi) below) and measure the amount of

35

label irreversibly bound to the NS5B (adduct) following photo-activation of the probe.

Preferably, according to a first aspect of the present invention, there is provided a probe of formula:



wherein

R¹ is selected from the group consisting of: H or (C₁₋₆)alkyl;

R² is CON(R²²)₂, wherein each **R²²** is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₅₋₇)cycloalkenyl, 6 or 10-membered aryl or **Het**, or both **R²²** are bonded together to form a 5, 6 or 7-membered saturated heterocycle with the nitrogen to which they are attached;

or **R²** is selected from: H, halogen, (C₁₋₆)alkyl, haloalkyl, (C₂₋₆)alkenyl, (C₅₋₇)cycloalkenyl, 6 or 10-membered aryl or **Het**; wherein each of said alkyl, haloalkyl, (C₂₋₆)alkenyl, (C₅₋₇)cycloalkenyl, aryl or **Het** is optionally substituted with **R²⁰**, wherein **R²⁰** is defined as:

- 1 to 4 substituents selected from: halogen, NO₂, cyano, azido, C(=NH)NH₂, C(=NH)NH(C₁₋₆)alkyl or C(=NH)NHCO(C₁₋₆)alkyl; or

- 1 to 4 substituents selected from:

a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with **R¹⁵⁰**;

b) OR¹⁰⁴ wherein **R¹⁰⁴** is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** being optionally substituted with **R¹⁵⁰**;

c) OCOR¹⁰⁵ wherein **R¹⁰⁵** is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** being optionally substituted with **R¹⁵⁰**;

d) SR¹⁰⁸, SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each **R¹⁰⁸** is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl,

Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both **R**¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with **R**¹⁵⁰;

5

e) NR¹¹¹**R**¹¹² wherein **R**¹¹¹ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and **R**¹¹² is H, CN, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, COOR¹¹⁵ or SO₂R¹¹⁵ wherein **R**¹¹⁵ is (C₁₋₆)alkyl, (C₃₋

10

₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both **R**¹¹¹ and **R**¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with **R**¹⁵⁰;

15

f) NR¹¹⁶CO**R**¹¹⁷ wherein **R**¹¹⁶ and **R**¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰;

20

g) NR¹¹⁸CON**R**¹¹⁹**R**¹²⁰, wherein **R**¹¹⁸, **R**¹¹⁹ and **R**¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or **R**¹¹⁸ is covalently bonded to **R**¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or **R**¹¹⁹ and **R**¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with **R**¹⁵⁰;

25

h) NR¹²¹CO**COR**¹²² wherein **R**¹²¹ and **R**¹²² is each is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰; or **R**¹²² is **OR**¹²³ or **N(R**¹²⁴**)**₂ wherein **R**¹²³ and each **R**¹²⁴ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or **R**¹²⁴ is OH or O(C₁₋₆alkyl) or both **R**¹²⁴ are covalently bonded together to form a 5, 6 or 7-membered saturated

30

heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;

i) COR¹²⁷ wherein R¹²⁷ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl,

5 aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

j) COOR¹²⁸ wherein R¹²⁸ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

10 k) CONR¹²⁹R¹³⁰ wherein R¹²⁹ and R¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the

nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl,

15 (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;

l) aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with R¹⁵⁰;

wherein R¹⁵⁰ is preferably:

- 1 to 3 substituents selected from: halogen, NO₂, cyano or azido; or

20 - 1 to 3 substituents selected from:

a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁶⁰;

b) OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆alkyl) or (C₃₋₇)cycloalkyl, said alkyl or cycloalkyl optionally substituted with R¹⁶⁰;

25 d) SR¹⁰⁸, SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, or both R¹⁰⁸ are covalently bonded together and

to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het** and

30 heterocycle being optionally substituted with R¹⁶⁰;

e) NR¹¹¹R¹¹² wherein R¹¹¹ is H, (C₁₋₆)alkyl, or (C₃₋₇)cycloalkyl, and R¹¹² is H, (C₁₋₆)alkyl or (C₃₋₇)cycloalkyl, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl or (C₃₋₇)cycloalkyl, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to

form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl and heterocycle being optionally substituted with R^{160} ;

f) $NR^{116}COR^{117}$ wherein R^{116} and R^{117} is each H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl said (C_{1-6}) alkyl and (C_{3-7}) cycloalkyl being optionally substituted with R^{160} ;

g) $NR^{118}CONR^{119}R^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or R^{118} is covalently bonded to R^{119} and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

said alkyl, cycloalkyl, and heterocycle being optionally substituted with R^{160} ;

h) $NR^{121}COCOR^{122}$ wherein R^{121} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said alkyl and cycloalkyl being optionally substituted with R^{160} ;

or R^{122} is OR^{123} or $N(R^{124})_2$ wherein R^{123} and each R^{124} is independently H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl and heterocycle being optionally substituted with R^{160} ;

i) COR^{127} wherein R^{127} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said alkyl and cycloalkyl being optionally substituted with R^{160} ;

j) $COOR^{128}$ wherein R^{128} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said (C_{1-6}) alkyl and (C_{3-7}) cycloalkyl being optionally substituted with R^{160} ; and

k) $CONR^{129}R^{130}$ wherein R^{129} and R^{130} are independently H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl and heterocycle being optionally substituted with R^{160} ;

wherein R^{160} is defined as 1 or 2 substituents selected from: halogen, CN, C_{1-6} alkyl, haloalkyl, $COOR^{161}$, OR^{161} , $N(R^{162})_2$, $SO_2N(R^{162})_2$, or $CON(R^{162})_2$, wherein R^{161} and each R^{162} is

independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl; or both **R**¹⁶² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

5

R³ is selected from (C₃₋₇)cycloalkyl, (C₆₋₁₀)bicycloalkyl, 6- or 10-membered aryl, or **Het**;

R⁵ is -C(O)-**Z**, wherein

10

Z is OR⁶ wherein **R**⁶ is C₁₋₆alkyl substituted with:

- 1 to 4 substituents selected from: OPO₃H, NO₂, cyano, azido, C(=NH)NH₂, C(=NH)NH(C₁₋₆)alkyl or C(=NH)NHCO(C₁₋₆)alkyl; or

- 1 to 4 substituents selected from:

15

a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with **R**¹⁵⁰;

b) OR¹⁰⁴ wherein **R**¹⁰⁴ is (C₁₋₆alkyl) substituted with **R**¹⁵⁰, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰;

20

c) OCOR¹⁰⁵ wherein **R**¹⁰⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰;

25

d) SR¹⁰⁸, SO₃H, SO₂N(**R**¹⁰⁸)₂ or SO₂N(**R**¹⁰⁸)C(O)**R**¹⁰⁸ wherein each **R**¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both **R**¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with **R**¹⁵⁰;

30

e) NR¹¹¹**R**¹¹² wherein **R**¹¹¹ is (C₁₋₆)alkyl substituted with **R**¹⁵⁰, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and **R**¹¹² is CN, (C₁₋₆)alkyl substituted with **R**¹⁵⁰, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋

₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with R¹⁵⁰;

f) NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

g) NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁵⁰;

h) NR¹²¹COCOR¹²² wherein R¹²¹ and R¹²² is each is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰; or R¹²² is OR¹²³ or N(R¹²⁴)₂ wherein R¹²³ and each R¹²⁴ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹²⁴ is OH or O(C₁₋₆alkyl) or both R¹²⁴ are

covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;

i) COR¹²⁷ wherein R¹²⁷ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

j) COOR¹²⁸ wherein R¹²⁸ is (C₁₋₆)alkyl substituted with R¹⁵⁰, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋

₆alkyl)**Het** being optionally substituted with R^{150} ;

k) $\text{CONR}^{129}\text{R}^{130}$ wherein R^{129} and R^{130} are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋

₆alkyl)**Het**, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R^{150} ;

l) aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with R^{150} ;

- 1 to 3 substituents selected from: halogen, NO₂, cyano, azido or

- 1 to 3 substituents selected from:

a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R^{160} ;

b) OR^{104} wherein R^{104} is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R^{160} ;

d) SO₃H, SO₂N(R^{108})₂ or SO₂N(R^{108})C(O) R^{108} wherein each R^{108} is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both R^{108} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R^{160} ;

e) $\text{NR}^{111}\text{R}^{112}$ wherein R^{111} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and R^{112} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R^{115} is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R^{111} and R^{112} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with R^{160} ;

- f) $\text{NR}^{116}\text{COR}^{117}$ wherein R^{116} and R^{117} is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R^{160} ;
- 5 g) $\text{NR}^{118}\text{CONR}^{119}\text{R}^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R^{160} ;
- 10 h) $\text{NR}^{121}\text{COCOR}^{122}$ wherein R^{121} is H, (C₁₋₆)alkyl optionally substituted with R^{160} ;
- or R^{122} is OR^{123} or $\text{N}(\text{R}^{124})_2$ wherein R^{123} and each R^{124} is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R^{124} is OH or O(C₁₋₆alkyl) or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R^{160} ;
- 15 i) tetrazole, COOR^{128} wherein R^{128} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R^{160} ; and
- 20 j) $\text{CONR}^{129}\text{R}^{130}$ wherein R^{129} and R^{130} are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R^{160} ;
- 25 k) $\text{CONR}^{129}\text{R}^{130}$ wherein R^{129} and R^{130} are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R^{160} ;
- 30 wherein R^{160} is defined as 1 or 2 substituents selected from: tetrazole, halogen, CN, C₁₋₆alkyl, haloalkyl, COOR^{161} , SO_3H , $\text{SO}_2\text{R}^{161}$, OR^{161} , $\text{N}(\text{R}^{162})_2$, $\text{SO}_2\text{N}(\text{R}^{162})_2$, or $\text{CON}(\text{R}^{162})_2$, wherein R^{161} and each R^{162} is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl; or both R^{162} are covalently bonded together and to the

nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

or Z is $N(R^{6a})R^6$, wherein R^{6a} is H or $(C_{1-6}alkyl)$; and

5

R^6 is $(C_{1-6}alkyl)$ optionally substituted with:

- 1 to 4 substituents selected from: OPO_3H , NO_2 , cyano, azido, $C(=NH)NH_2$, $C(=NH)NH(C_{1-6}alkyl)$ or $C(=NH)NHCO(C_{1-6}alkyl)$; or

- 1 to 4 substituents selected from:

10

a) $(C_{1-6}alkyl)$ substituted with R^{150a} , haloalkyl, $(C_{3-7}cycloalkyl)$, C_{3-7} spirocycloalkyl optionally containing 1 or 2 heteroatom, $(C_{2-6}alkenyl)$, $(C_{2-6}alkynyl)$, $(C_{1-6}alkyl)-(C_{3-7}cycloalkyl)$, all of which optionally substituted with R^{150} , wherein R^{150a} is the same as R^{150} but is not halogen, OR^{150b} , $COOR^{150b}$, $N(R^{150b})_2$, wherein R^{150b} is H or $C_{1-6}alkyl$;

15

b) OR^{104} wherein R^{104} is $(C_{1-6}alkyl)$ substituted with R^{150} , $(C_{3-7}cycloalkyl)$, or $(C_{1-6}alkyl)-(C_{3-7}cycloalkyl)$, aryl, Het, $(C_{1-6}alkyl)aryl$ or $(C_{1-6}alkyl)Het$, said cycloalkyl, aryl, Het, $(C_{1-6}alkyl)aryl$ or $(C_{1-6}alkyl)Het$ being optionally substituted with R^{150} ;

20

c) $OCOR^{105}$ wherein R^{105} is $(C_{1-6}alkyl)$, $(C_{3-7}cycloalkyl)$, $(C_{1-6}alkyl)-(C_{3-7}cycloalkyl)$, Het, $(C_{1-6}alkyl)aryl$ or $(C_{1-6}alkyl)Het$, said alkyl, cycloalkyl, aryl, Het, $(C_{1-6}alkyl)aryl$ or $(C_{1-6}alkyl)Het$ being optionally substituted with R^{150} ;

25

d) SO_3H , $SO_2N(R^{108})_2$ or $SO_2N(R^{108})C(O)R^{108}$ wherein each R^{108} is independently H, $(C_{1-6}alkyl)$, $(C_{3-7}cycloalkyl)$ or $(C_{1-6}alkyl)-(C_{3-7}cycloalkyl)$, aryl, Het, $(C_{1-6}alkyl)aryl$ or $(C_{1-6}alkyl)Het$ or both R^{108} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, Het, $(C_{1-6}alkyl)aryl$ or $(C_{1-6}alkyl)Het$ or heterocycle being optionally substituted with R^{150} ;

30

e) $NR^{111}R^{112}$ wherein R^{111} is $(C_{1-6}alkyl)$ substituted with R^{150} , $(C_{3-7}cycloalkyl)$ or $(C_{1-6}alkyl)-(C_{3-7}cycloalkyl)$, aryl, Het, $(C_{1-6}alkyl)aryl$ or $(C_{1-6}alkyl)Het$, and R^{112} is H, CN, $(C_{1-6}alkyl)$, $(C_{3-7}cycloalkyl)$ or $(C_{1-6}alkyl)-(C_{3-7}cycloalkyl)$, aryl, Het, $(C_{1-6}alkyl)aryl$, $(C_{1-6}alkyl)Het$ or

R^{111} is H and R^{112} is SO_2R^{115} wherein R^{115} is $(C_{1-6}alkyl)$, $(C_{3-7}cycloalkyl)$, or $(C_{1-6}alkyl)-(C_{3-7}cycloalkyl)$, aryl, Het, $(C_{1-6}alkyl)aryl$ or $(C_{1-6}alkyl)Het$, or both

R^{111} and R^{112} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said cycloalkyl, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$, or heterocycle being optionally substituted with R^{150} ;

- 5 **f)** $NR^{116}COR^{117}$ wherein R^{116} and R^{117} is each H, $(C_{1-6})\text{alkyl}$, $(C_{3-7})\text{cycloalkyl}$, $(C_{1-6})\text{alkyl}-(C_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$, said $(C_{1-6})\text{alkyl}$, $(C_{3-7})\text{cycloalkyl}$, $(C_{1-6})\text{alkyl}-(C_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$ being optionally substituted with R^{150} ;
- 10 **g)** $NR^{118}CONR^{119}R^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, $(C_{1-6})\text{alkyl}$, $(C_{3-7})\text{cycloalkyl}$, $(C_{1-6})\text{alkyl}-(C_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$, or R^{118} is covalently bonded to R^{119} and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;
- 15 said alkyl, cycloalkyl, $(C_{1-6})\text{alkyl}-(C_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$ or heterocycle being optionally substituted with R^{150} ;
- h)** $NR^{121}COCOR^{122}$ wherein R^{121} and R^{122} is each is H, $(C_{1-6})\text{alkyl}$, $(C_{3-7})\text{cycloalkyl}$, $(C_{1-6})\text{alkyl}-(C_{3-7})\text{cycloalkyl}$, a 6- or 10-membered aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$ being optionally substituted with R^{150} ;
- 20 or R^{122} is OR^{123} or $N(R^{124})_2$ wherein R^{123} and each R^{124} is independently H, $(C_{1-6})\text{alkyl}$, $(C_{3-7})\text{cycloalkyl}$, or $(C_{1-6})\text{alkyl}-(C_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$, or R^{124} is OH or $O(C_{1-6}\text{alkyl})$ or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated
- 25 heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$ and heterocycle being optionally substituted with R^{150} ;
- i)** COR^{127} wherein R^{127} is H, $(C_{1-6})\text{alkyl}$, $(C_{3-7})\text{cycloalkyl}$ or $(C_{1-6})\text{alkyl}-(C_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$, said alkyl, cycloalkyl, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$ being optionally substituted with R^{150} ;
- 30 **j)** $COOR^{128}$ wherein R^{128} is $(C_{1-6})\text{alkyl}$ substituted with R^{150} , $(C_{3-7})\text{cycloalkyl}$, or $(C_{1-6})\text{alkyl}-(C_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$, said $(C_{3-7})\text{cycloalkyl}$, or $(C_{1-6})\text{alkyl}-(C_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ and $(C_{1-6}\text{alkyl})\text{Het}$ being optionally substituted with R^{150} ;
- k)** $CONR^{129}R^{130}$ wherein R^{129} and R^{130} are independently H, $(C_{1-6})\text{alkyl}$, $(C_{3-7})\text{cycloalkyl}$, $(C_{1-6})\text{alkyl}-(C_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(C_{1-6}\text{alkyl})\text{aryl}$ or $(C_{1-6}\text{alkyl})\text{Het}$, or heterocycle being optionally substituted with R^{150} ;

₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;

l) aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with R¹⁵⁰; and

wherein R¹⁵⁰ is selected from:

- 1 to 3 substituents selected from: halogen, NO₂, cyano, azido or

- 1 to 3 substituents selected from:

a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁶⁰;

b) OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁶⁰;

d) SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both R¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁶⁰;

e) NR¹¹¹R¹¹² wherein R¹¹¹ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and R¹¹² is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with R¹⁶⁰;

f) $\text{NR}^{116}\text{COR}^{117}$ wherein R^{116} and R^{117} is each H, $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6}\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6}\text{alkyl})\text{Het}$, said $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6}\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6}\text{alkyl})\text{Het}$ being optionally substituted with R^{160} ;

g) $\text{NR}^{118}\text{CONR}^{119}\text{R}^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6}\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6}\text{alkyl})\text{Het}$, or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6}\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6}\text{alkyl})\text{Het}$ or heterocycle being optionally substituted with R^{160} ;

h) $\text{NR}^{121}\text{COCOR}^{122}$ wherein R^{121} is H, $(\text{C}_{1-6})\text{alkyl}$ optionally substituted with R^{160} ;

or R^{122} is OR^{123} or $\text{N}(\text{R}^{124})_2$ wherein R^{123} and each R^{124} is independently H, $(\text{C}_{1-6}\text{alkyl})$, $(\text{C}_{3-7})\text{cycloalkyl}$, or $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6}\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6}\text{alkyl})\text{Het}$, or R^{124} is OH or $\text{O}(\text{C}_{1-6}\text{alkyl})$ or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, $(\text{C}_{1-6}\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6}\text{alkyl})\text{Het}$ and heterocycle being optionally substituted with R^{160} ;

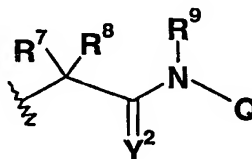
i) tetrazole, COOR^{128} wherein R^{128} is H, $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, or $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6}\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6}\text{alkyl})\text{Het}$, said $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, or $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6}\text{alkyl})\text{aryl}$ and $(\text{C}_{1-6}\text{alkyl})\text{Het}$ being optionally substituted with R^{160} ; and

k) $\text{CONR}^{129}\text{R}^{130}$ wherein R^{129} and R^{130} are independently H, $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6}\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6}\text{alkyl})\text{Het}$, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, $(\text{C}_{1-6}\text{alkyl})\text{aryl}$, $(\text{C}_{1-6}\text{alkyl})\text{Het}$ and heterocycle being optionally substituted with R^{160} ;

wherein R^{160} is defined as 1 or 2 substituents selected from:

tetrazole, halogen, CN, C₁₋₆alkyl, haloalkyl, COOR¹⁶¹, SO₃H, SO₂R¹⁶¹, OR¹⁶¹, N(R¹⁶²)₂, SO₂N(R¹⁶²)₂, or CON(R¹⁶²)₂, wherein R¹⁶¹ and each R¹⁶² is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl; or both R¹⁶² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle.

or R⁶ is



wherein, preferably, R⁷ and R⁸ are each independently H, (C₁₋₆)alkyl, haloalkyl, (C₃₋₇)cycloalkyl, 6- or 10-membered aryl, Het, (C₁₋₆)alkyl-aryl, (C₁₋₆)alkyl-Het, wherein said alkyl, cycloalkyl, aryl, Het, (C₁₋₆)alkyl-aryl, (C₁₋₆)alkyl-Het are optionally substituted with R⁷⁰; or

R⁷ and R⁸ are covalently bonded together to form second (C₃₋₇)cycloalkyl or a 4, 5- or 6-membered heterocycle having from 1 to 3 heteroatom selected from O, N, and S; or when Z is N(R^{6a})R⁶, either of R⁷ or R⁸ is covalently bonded to R^{6a} to form a nitrogen-containing 5-or 6-membered heterocycle;

wherein, preferably, R⁷⁰ is selected from:

- 1 to 4 substituents selected from: halogen, NO₂, cyano, azido; or

- 1 to 4 substituents selected from:

a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁵⁰;

b) OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het, said alkyl, cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het being optionally substituted with R¹⁵⁰;

d) SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het or both R¹⁰⁸ are covalently bonded together and to

the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁵⁰;

5 e) NR¹¹¹R¹¹² wherein R¹¹¹ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and R¹¹² is H, CN, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹¹¹ and R¹¹² are covalently bonded together and to the
10 nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with R¹⁵⁰;

f) NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or
15 (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

g) NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which
20 they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁵⁰;

h) NR¹²¹COCOR¹²² wherein R¹²¹ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or
25 (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

and R¹²² is OR¹²³ or N(R¹²⁴)₂ wherein R¹²³ and each R¹²⁴ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹²⁴ is OH or O(C₁₋₆alkyl) or both R¹²⁴ are
30 covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;

- i) COR^{127} wherein R^{127} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R^{150} ;
- 5 j) COOR^{128} wherein R^{128} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R^{150} ;
- 10 k) $\text{CONR}^{129}\text{R}^{130}$ wherein R^{129} and R^{130} are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R^{150} ;
- 15 l) aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with R^{150} ;
- wherein, preferably, R^{150} is selected from:
- 1 to 3 substituents selected from: halogen, NO₂, cyano, azido; or
 - 1 to 3 substituents selected from:
- 20 a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, all of which optionally substituted with R^{160} ;
- b) OR^{104} wherein R^{104} is H, (C₁₋₆alkyl) or (C₃₋₇)cycloalkyl, said alkyl and cycloalkyl being optionally substituted with R^{160} ;
- d) $\text{SO}_2\text{N}(\text{R}^{108})_2$ wherein R^{108} is H, (C₁₋₆)alkyl or (C₃₋₇)cycloalkyl, said alkyl or cycloalkyl being optionally substituted with R^{160} ;
- 25 e) $\text{NR}^{111}\text{R}^{112}$ wherein R^{111} is H, (C₁₋₆)alkyl or (C₃₋₇)cycloalkyl, and R^{112} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, COOR^{115} or $\text{SO}_2\text{R}^{115}$ wherein R^{115} is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R^{111} and R^{112} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with R^{160} ;
- 30

f) $\text{NR}^{116}\text{COR}^{117}$ wherein R^{116} and R^{117} is each H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl being optionally substituted with R^{160} ;

g) $\text{NR}^{118}\text{CONR}^{119}\text{R}^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl; or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl or heterocycle being optionally substituted with R^{160} ;

h) $\text{NR}^{121}\text{COCOR}^{122}$ wherein R^{121} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said alkyl or cycloalkyl being optionally substituted with R^{160} ; or R^{122} is OR^{123} or $\text{N}(\text{R}^{124})_2$ wherein R^{123} and each R^{124} is independently H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or R^{124} is OH or $\text{O}(\text{C}_{1-6})$ alkyl or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl and heterocycle being optionally substituted with R^{160} ;

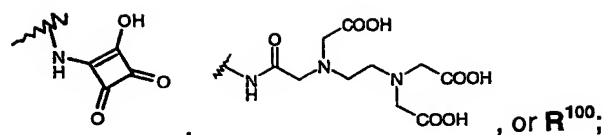
j) tetrazole, COOR^{128} wherein R^{128} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said (C_{1-6}) alkyl and (C_{3-7}) cycloalkyl being optionally substituted with R^{160} ; and

k) $\text{CONR}^{129}\text{R}^{130}$ wherein R^{129} and R^{130} are independently H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl and heterocycle being optionally substituted with R^{160} ;

wherein R^{160} is defined as 1 or 2 substituents selected from: tetrazole, halogen, CN, C_{1-6} alkyl, haloalkyl, COOR^{161} , OR^{161} , $\text{N}(\text{R}^{162})_2$ or $\text{CON}(\text{R}^{162})_2$, wherein R^{161} and each R^{162} is independently H or (C_{1-6}) alkyl;

R^9 is H; or R^9 is covalently bonded to either of R^7 or R^8 to form a 5- or 6-membered heterocycle; and

Q is a 6- or 10-membered aryl, **Het**, all of which being optionally substituted with:



wherein R^{100} is:

- 1 to 4 substituents selected from: halogen, NO_2 , cyano or azido; or
- 1 to 4 substituents selected from:
 - a) (C_{1-6}) alkyl or haloalkyl, (C_{3-7}) cycloalkyl, (C_{2-6}) alkenyl, (C_{2-8}) alkynyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, all of which optionally substituted with R^{150} ;
 - b) OR^{104} wherein R^{104} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** being optionally substituted with R^{150} ;
 - c) $NR^{111}R^{112}$ wherein R^{111} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, and R^{112} is H, CN, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl, (C_{1-6}) alkyl)**Het**, $COOR^{115}$ or SO_2R^{115} wherein R^{115} is (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, or both R^{111} and R^{112} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, or heterocycle being optionally substituted with R^{150} ;
 - d) $NR^{116}COR^{117}$ wherein R^{116} and R^{117} is each H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, said (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** being optionally substituted with R^{150} ;
 - e) $NR^{118}CONR^{119}R^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, or R^{118} is covalently bonded to R^{119} and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** or heterocycle being optionally substituted with R^{150} ;
 - f) $NR^{121}COCOR^{122}$ wherein R^{121} and R^{122} is each is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, or heterocycle being optionally substituted with R^{150} ;

- ₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰; or R¹²² is OR¹²³ or N(R¹²⁴)₂ wherein R¹²³ and each R¹²⁴ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹²⁴ is OH or O(C₁₋₆alkyl) or both R¹²⁴ are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;
- j)** COOR¹²⁸ wherein R¹²⁸ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;
- k)** CONR¹²⁹R¹³⁰ wherein R¹²⁹ and R¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;
- l)** aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with R¹⁵⁰;
- wherein R¹⁵⁰ is selected from:
- 1 to 3 substituents selected from: halogen, NO₂, cyano or azido; or
 - 1 to 3 substituents selected from:
 - a)** (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁶⁰;
 - b)** OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁶⁰;
 - d)** SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both R¹⁰⁸ are

covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁶⁰;

5 **e)** NR¹¹¹R¹¹² wherein R¹¹¹ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and R¹¹² is H, CN, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with R¹⁶⁰;

10 **f)** NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁶⁰;

15 **g)** NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

20 or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

25 said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁶⁰;

30 **h)** NR¹²¹COCOR¹²² wherein R¹²¹ is H, (C₁₋₆)alkyl optionally substituted with R¹⁶⁰;

or R¹²² is OR¹²³ or N(R¹²⁴)₂ wherein R¹²³ and each R¹²⁴ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋

₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹²⁴ is OH or O(C₁₋₆alkyl) or both R¹²⁴ are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁶⁰;

j) tetrazole, COOR¹²⁸ wherein R¹²⁸ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁶⁰; and

k) CONR¹²⁹R¹³⁰ wherein R¹²⁹ and R¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁶⁰;

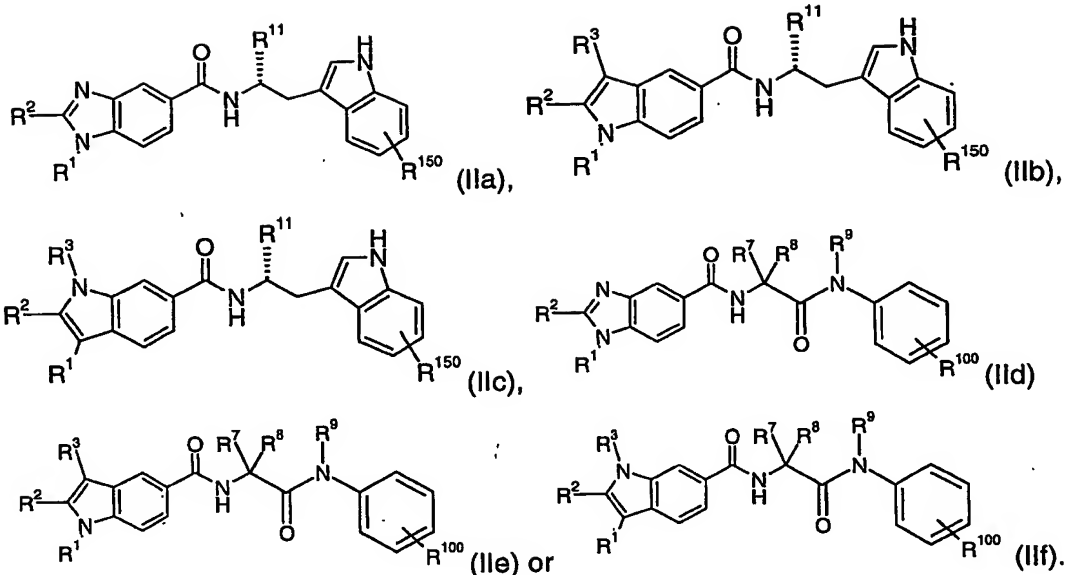
wherein R¹⁶⁰ is defined as 1 or 2 substituents selected from: tetrazole, halogen, CN, C₁₋₆alkyl, haloalkyl, COOR¹⁶¹, SO₃H, SR¹⁶¹, SO₂R¹⁶¹, OR¹⁶¹, N(R¹⁶²)₂, SO₂N(R¹⁶²)₂, or CON(R¹⁶²)₂, wherein R¹⁶¹ and each R¹⁶² is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl; or both R¹⁶² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

or a salt thereof;

wherein said probe comprises a detectable label attached to any suitable position, whereby said probe binds to an HCV polymerase or an analog thereof and is capable of being displaced by an inhibitor thereof.

More preferably, the probe of the invention is a compound of formula:

40



wherein R^1 is (C₅₋₆)cycloalkyl;

5

R^2 is phenyl, or Het both being optionally substituted with R^{20} ;

R^3 , R^7 , R^8 , R^9 , R^{100} , and R^{150} are as defined above;

10 R^{11} is OPO₃H, NO₂, cyano, azido, C(=NH)NH₂, C(=NH)NH(C₁₋₆)alkyl or C(=NH)NHCO(C₁₋₆)alkyl; or

15 a) (C₁₋₆) alkyl substituted with R^{150a} , haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₆)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R^{150} , wherein R^{150a} is the same as R^{150} but is not halogen, OR^{150b}, COOR^{150b}, N(R^{150b})₂, wherein R^{150b} is H or C₁₋₆alkyl;

20 b) OR¹⁰⁴ wherein R^{104} is (C₁₋₆alkyl) substituted with R^{150} , (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het being optionally substituted with R^{150} ;

25 c) OCOR¹⁰⁵ wherein R^{105} is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said alkyl, cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het being optionally substituted with R^{150} ;

d) SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R^{108} is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl,

Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het or both R¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het or heterocycle being optionally substituted with R¹⁵⁰;

e) NR¹¹¹R¹¹² wherein R¹¹¹ is (C₁₋₆)alkyl substituted with R¹⁵⁰, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, and R¹¹² is H, CN, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)Het or

R¹¹¹ is H and R¹¹² is SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or heterocycle being optionally substituted with R¹⁵⁰;

f) NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het being optionally substituted with R¹⁵⁰;

g) NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het or heterocycle being optionally substituted with R¹⁵⁰;

h) NR¹²¹COCOR¹²² wherein R¹²¹ and R¹²² is each is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het being optionally substituted with R¹⁵⁰; or R¹²² is OR¹²³ or N(R¹²⁴)₂ wherein R¹²³ and each R¹²⁴ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or R¹²⁴ is OH or O(C₁₋₆alkyl) or both R¹²⁴ are

covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;

i) COR¹²⁷ wherein R¹²⁷ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

j) COOR¹²⁸ wherein R¹²⁸ is (C₁₋₆)alkyl substituted with R¹⁵⁰, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

k) CONR¹²⁹R¹³⁰ wherein R¹²⁹ and R¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated

heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;

l) aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with R¹⁵⁰

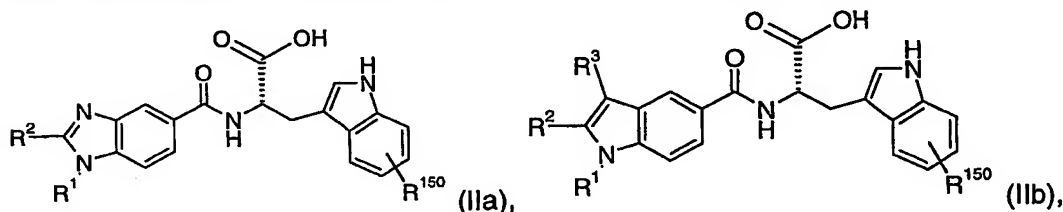
wherein R¹⁵⁰ is as defined herein;

or a salt thereof;

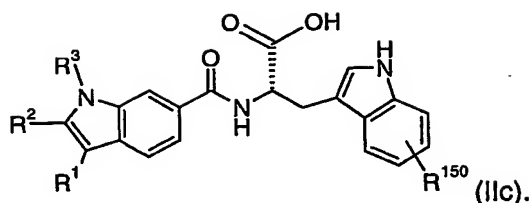
wherein said compound is either:

- a) marked with a radioactive isotope at any suitable position;
- b) linked to a detectable moiety by a suitable linker at any suitable position, except R¹ and R³; or
- c) linked to an affinity tag at any suitable position, except R¹ and R³.

Even more preferably, the probe of the invention is a compound of formula:



43



wherein

R¹ is (C₅₋₆)cycloalkyl;

R² is phenyl, or Het both being optionally substituted with R²⁰;

5 R³ and R¹⁵⁰ are as defined above;

or a salt thereof;

wherein said compound is optionally:

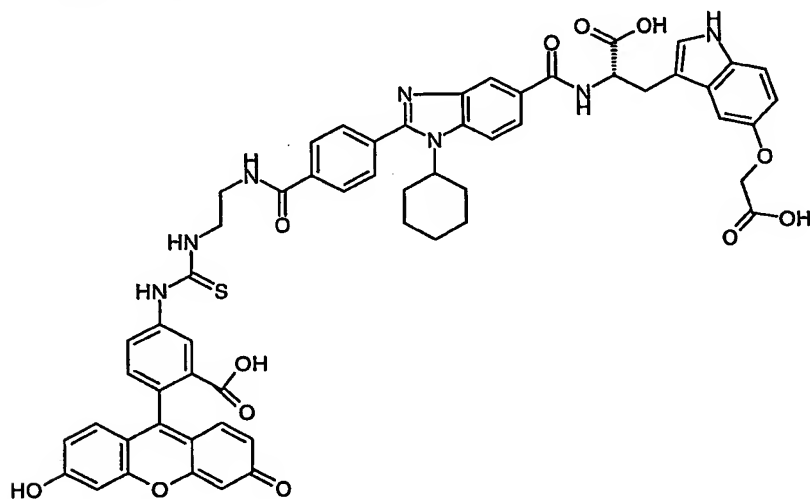
a) marked with a radioactive isotope at any suitable position;

b) linked to a detectable moiety by a suitable linker at any suitable position,

10 except R¹ and R³; or

c) linked to an affinity tag at any suitable position, except R¹ and R³.

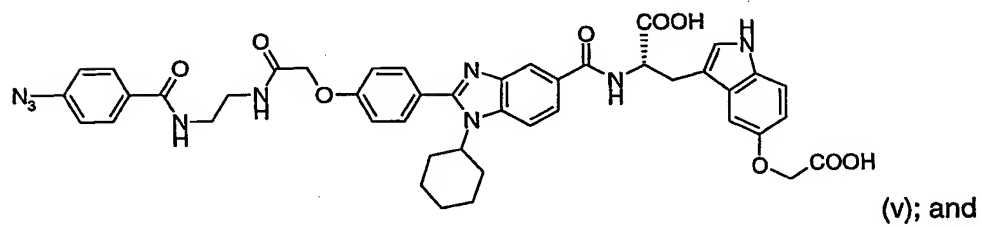
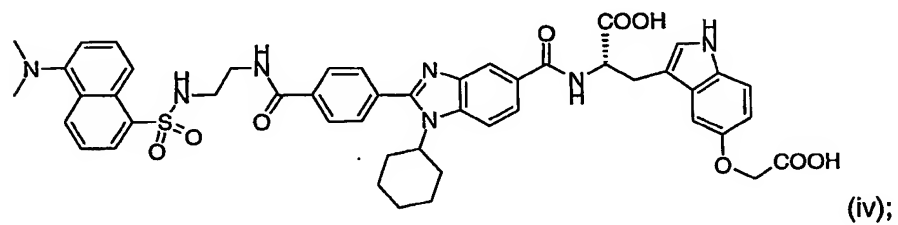
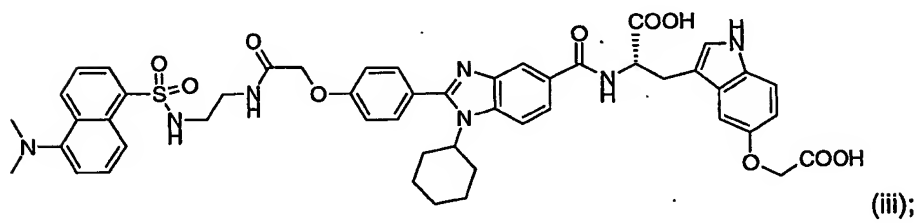
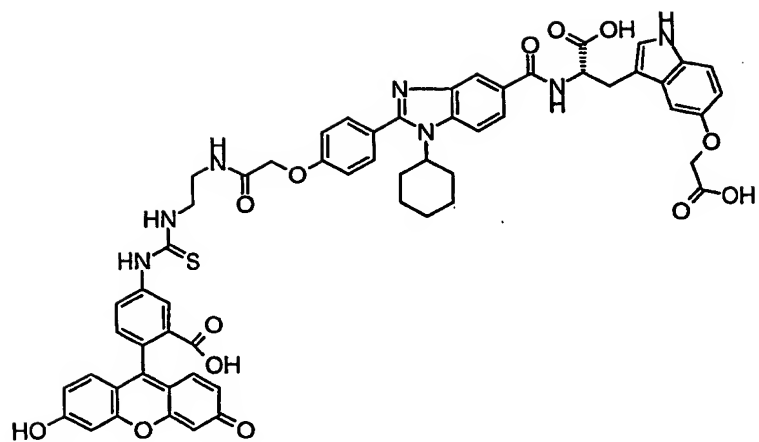
Specifically, according to a first aspect of the invention, the probe of the present invention is selected from the group consisting of:



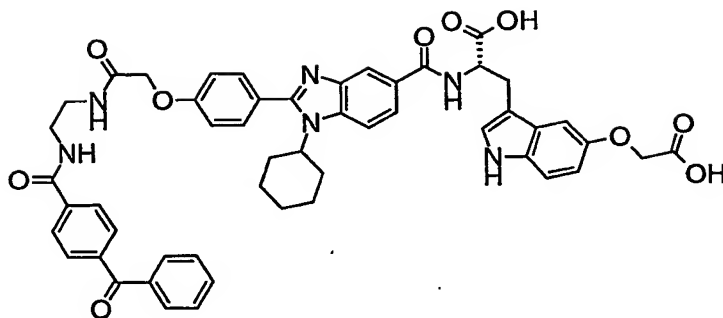
15

(I);

44



45



(vi)

According to an alternative aspect of this first embodiment, there is provided a method for identifying compounds that inhibit HCV polymerase comprising the steps

5 of:

- a) contacting said HCV polymerase or an analog thereof with a probe of formula I, as defined herein, so as to form a complex having said probe bound to said polymerase;
- b) measuring the signal from said complex to establish a base line level;
- c) incubating the product of step a) with a test compound; and
- d) measuring the signal from said complex; and
- e) comparing the signal from step d) with the signal from step b);

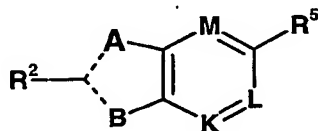
whereby a modulation in said signal is an indication that said test compound inhibits said polymerase.

15

Preferably, the method for identifying compounds capable of inhibiting HCV polymerase, comprises:

- f) repeating steps (a) to (e), as defined above in a high throughput screen.

20 Alternatively, there is provided a probe of formula I:



1

A is O, S, NR³, or CR³;

B is NR^1 or CR^1 ; with the proviso that, when **A** is CR^3 , **B** is NR^1 , and when **A** is O or S, **B** is CR^1 ;

46

----- represents either a single or a double bond;

R¹ is selected from the group consisting of: (C₄₋₇)cycloalkyl optionally substituted with (C₁₋₆ alkyl); norbornane, 5-, 6- or 7-membered heterocycle having 1 to 4 heteroatoms selected from O, N, and S, all of which optionally substituted with 1 to 4 substituent

5 selected from the group consisting of:

halo, OH and C₁₋₆ alkyl optionally substituted with hydroxy;

R² is selected from the group consisting of: phenyl, pyridine-N-oxide, 5- or 6-membered aromatic heterocycle having 1 to 4 heteroatoms selected from O, N, and S, and 9- or 10-membered aromatic heterobicycle having 1 to 4 heteroatoms

10 selected from O, N and S;

said phenyl, pyridine-N-oxide, aromatic heterocycle and aromatic heterobicycle being optionally substituted with from 1 to 4 substituents

selected from the group consisting of: halogen, C₁₋₆ haloalkyl, (C₁₋₆)alkyl, C₁₋₆ alkoxy, OH, amino optionally mono- or di-substituted with C₁₋₆ alkyl;

15 **R³** is selected from the group consisting of: H, (C₁₋₆)alkyl, (C₁₋₆ alkyl)-(C₆₋₁₀aryl), (C₁₋₆ alkyl)-5- or 6-membered heterocycle having 1 to 4 heteroatoms selected from O, N, and S, and 5- or 6-membered heterocycle having 1 to 4 heteroatoms selected from O, N and S,

wherein said aryl and said heterocycle are optionally substituted with from 1
20 to 4 substituents selected from the group consisting of: COOH, COO(C₁₋₆ alkyl), halogen, and (C₁₋₆ alkyl);

M is N, CR^{4a}, or COR^{4b}, wherein **R^{4a}** is selected from the group consisting of: H, halogen, and (C₁₋₆ alkyl); and **R^{4b}** is selected from the group consisting of: H and (C₁₋₆ alkyl);

25 **K** and **L** is each independently N or CR⁶, wherein **R⁶** is H, halo, C₁₋₆ alkyl, OH, or C₁₋₆ alkoxy;

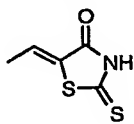
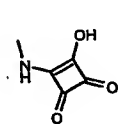
R⁵ is -C(Y)-Z, wherein Y is O or S; and Z is NHR^{5a} or OR^{5a};
wherein:

R^{5a} is selected from the group consisting of: H, (C₁₋₆)alkyl, (C₂₋₆)alkenyl,
30 (C₃₋₆)cycloalkyl optionally substituted with C₁₋₆alkyl or C₂₋₆alkenyl, (C₆₋₁₀)aryl optionally substituted with C₁₋₆alkyl or C₂₋₆alkenyl, N{(C₁₋₆ alkyl)}₂, NHCOO(C₁₋₆)alkyl(C₆₋₁₀)aryl, NHCO(C₆₋₁₀)aryl, -5- or 6-atom heterocycle, having 1 to 4 heteroatoms selected from O, N and S, and -9- or 10-atom heterobicycle having 1 to 4 heteroatoms selected from O, N and S;

47

wherein said alkyl, alkenyl, cycloalkyl, aryl, heterocycle or heterobicyclic are all optionally substituted with from 1 to 4 substituents selected from: OH, COOH, (C₁₋₆)alkyl, (C₂₋₄)alkenyl, (C₁₋₆)alkyl-hydroxy, COO(C₁₋₆)alkyl, C₃₋₇ cycloalkyl, benzyloxy, halogen, (C₂₋₄)alkenyl-(C₁₋₆)alkyl-COOH, coumarin, (C₁₋₆)alkyl-amino, NH(C₁₋₆ alkyl), C(halogen)₃, -C(O)NH(C₁₋₄)alkyl, and -C(O)NH(C₆₋₁₀)aryl, 5- or 6-membered heterocycle having 1 to 4 heteroatoms selected from O, N and S, 9- or 10-membered heterobicyclic having 1 to 4 heteroatoms selected from O, N and S, and 6- or 10-membered aryl;

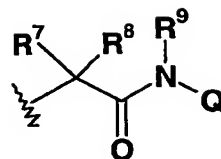
wherein said alkyl, alkenyl, cycloalkyl, aryl, heterocycle and heterobicyclic are all optionally substituted with from 1 to 4 substituents selected from: halogen, OPO₃H, sulfonamido, SO₃H, SO₂CH₃, -CONH₂, -COCH₃, (C₁₋₃)alkyl, (C₂₋₄alkenyl)COOH, tetrazolyl, COOH, -CONH₂, triazolyl, OH, NO₂, NH₂, -O(C₁₋₆ alkyl)COOH, hydantoin, benzoyleneurea, (C₁₋₄)alkoxy, cyano, azido, -O-(C₁₋₆)alkyl COOH, -O-(C₁₋₆)alkyl COO-(C₁₋₆)alkyl, NHCO-(C₁₋₆alkyl), -NHCOCO₂H, -NHCOCO₂NHCH₃, -NHCO(C₁₋₆)alkyl-COOH, -NHCOCONH(C₁₋₆)alkyl-COOH, -NHCO(C₃₋₇)cycloalkyl-COOH, -NHCONH(C₆₋₁₀)aryl-COOH, -NHCONH(C₆₋₁₀)aryl-COO(C₁₋₆)alkyl, -NHCONH(C₁₋₆)alkyl-COOH, -NHCONH(C₁₋₆)alkyl-COO(C₁₋₆)alkyl, -NHCONH(C₁₋₆)alkyl-(C₂₋₆)alkenyl-COOH, -NH(C₁₋₆)alkyl-(C₆₋₁₀)aryl-O(C₁₋₆)alkyl COOH, -NH(C₁₋₆)alkyl-(C₆₋₁₀)aryl-COOH, -NHCH₂COOH, -NHCONH₂, -NHCO(C₁₋₆)hydroxyalkyl COOH, -OCO(C₁₋₆)hydroxyalkyl COOH, (C₃₋₆)cycloalkyl COOH,



, -NHCN, -NHCHO, -NHSO₂CH₃, -NHSO₂CF₃; and -O(C₁₋₆alkyl)-tetrazol;

30 or R^{5a} is

48



- wherein R^7 and R^8 are each independently H, (C_{1-6} alkyl), (C_{3-7} cycloalkyl), (C_{1-6} alkyl)phenyl, (C_{1-6} alkyl)-(C_{3-7} cycloalkyl), (C_{3-7} cycloalkyl)-(C_{1-6} alkyl), (C_{3-7} cycloalkyl)-(C_{2-4} alkenyl), (C_{1-6} alkyl)-OH, phenyl, CH_2 biphenyl, 5- or 6-membered
- 5 heterocycle having from 1 to 4 heteroatoms selected from O, N, and S, 9- or 10-membered heterobicyclic having 1 to 4 heteroatoms selected from O, N, and S, (C_{1-6} alkyl)-5- or 6-membered heterocycle having from 1 to 4 heteroatoms selected from O, N, and S, or (C_{1-6} alkyl)-9- or 10-membered heterobicyclic having 1 to 4 heteroatoms selected from O, N, and S,
- 10 or R^7 and R^8 are covalently bonded together to form (C_{3-7} cycloalkyl), 4-, 5- or 6-membered heterocycle having from 1 to 4 heteroatoms selected from O, N, and S; or one of R^7 or R^8 is covalently bonded to R^9 to form a pyrrolidine;

- wherein said alkyl, cycloalkyl, heterocycle, heterobicyclic, phenyl are optionally substituted with from 1 to 4 substituents selected from the group
- 15 consisting of: OH, COOH, (C_{1-6} alkyl), (C_{2-4} alkenyl), CONH₂, NH₂, NH(C_{1-6} alkyl), N(C_{1-6} alkyl)₂, NHCOCOOH, NHCOCOON(C_{1-6} alkyl)₂, NHCOCOONH(C_{1-6} alkyl), SH, S(C_{1-6} alkyl), NHC(=NH)NH₂, halogen, and COO(C_{1-6} alkyl);

R^9 is H or (C_{1-6} alkyl); and

- Q is selected from the group consisting of: (C_{1-3} alkyl)CONHaryl, 6- or 10-membered
- 20 aryl, biphenyl, 5- or 6-atom heterocycle having 1 to 4 heteroatoms selected from O, N and S, 9- or 10-membered heterobicyclic having 1 to 4 heteroatoms selected from O, N and S;

- wherein said aryl, biphenyl, heterocycle and heterobicyclic are all optionally substituted with from 1 to 4 substituents selected from: OH, COOH,
- 25 COO(C_{1-6})alkyl, (C_{1-6})alkyl, (C_{1-6})alkylCOOH, (C_{1-6} alkyl)(C_{2-4} alkynyl), (C_{1-6})alkyl-hydroxy, phenyl, benzyloxy, halogen, (C_{2-4})alkenyl, (C_{2-4})alkenyl- (C_{1-6})alkyl-COOH, 5- or 6-membered second heterocycle having 1 to 4 heteroatoms selected from O, N and S, NH-5- or 6- membered second heterocycle having 1 to 4 heteroatoms selected from O, N, and S,

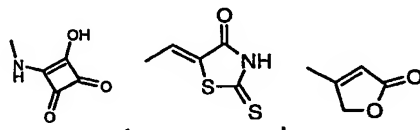
- 30 wherein said second heterocycle and phenyl being optionally substituted with from 1 to 4 substituents selected from: (C_{1-6} alkyl), CF₃, OH, (C_{1-6} alkyl) COOH, O(C_{1-6} alkyl)COOH, (C_{1-6} alkyl) COO(C_{1-6} alkyl),

alkyl), CH₂phenyl, COO(C₁₋₆ alkyl), (C₁₋₆alkyl)O(C₁₋₆alkyl), COOH, NCH(C₁₋₆alkyl)₂, NCO(C₁₋₆ alkyl), NH₂, NH(C₁₋₆ alkyl), halogen, N(C₁₋₆ alkyl)₂; and C₂₋₆ alkenyl-COOH

halogen, OPO₃H, benzyl, sulfonamido, SH, SOCH₃, SO₃H, SO₂CH₃, S(C₁₋₆ alkyl)COOH, -CONH₂, -COCH₃, (C₁₋₃)alkyl, (C₂₋₄alkenyl)COOH

wherein said alkenyl is optionally substituted with from 1 to 2 (C₁₋₆ alkyl) substituents,

(C₂₋₄alkenyl)COO(C₁₋₆alkyl), tetrazolyl, COOH, triazolyl, OH, NO₂, NH₂, - O(C₁₋₆ alkyl)COOH, hydantoin, benzoyleneurea, (C₁₋₄)alkoxy, (C₁₋₄)alkoxy(C₁₋₆ alkyl)COOH, cyano, azido, -O-(C₁₋₆)alkyl COOH, -O-(C₁₋₆)alkyl COO-(C₁₋₆)alkyl, -NHCOCOOH, -NHCOCOCONHOH, -NHCOCOCONH₂, -NHCOCOCONHCH₃, -NHCO(C₁₋₆)alkyl-COOH, -NHCOCONH(C₁₋₆)alkyl-COOH, -NHCO(C₃₋₇)cycloalkyl-COOH, -NHCONH(C₆₋₁₀)aryl-COOH, - NHCONH(C₆₋₁₀)aryl-COO(C₁₋₆)alkyl, - NHCONH(C₁₋₆)alkyl-COOH, - NHCONH(C₁₋₆)alkyl-COO(C₁₋₆)alkyl, - NHCONH(C₁₋₆)alkyl-(C₂₋₆)alkenyl-COOH, - NH(C₁₋₆)alkyl-(C₆₋₁₀)aryl-O(C₁₋₆)alkyl COOH, - NH(C₁₋₆)alkyl-(C₆₋₁₀)aryl-COOH, -NHCH₂COOH, -NHCONH₂, -NHCO(C₁₋₆)hydroxyalkyl COOH, -OCO(C₁₋₆)hydroxyalkyl COOH, (C₃₋₆)cycloalkyl COOH,



, -NHCN, -NHCHO, -NHSO₂CH₃,

-NHSO₂CF₃, coumarin, (C₁₋₆)alkyl-amino, NH(C₁₋₆alkyl)₂, C(halogen)₃, -NH(C₂₋₄)acyl, -NH(C₆₋₁₀)aroyl, -CONH(C₁₋₆alkyl), -CO(C₁₋₆)alkyl-COOH, -CONH(C₁₋₆)alkyl-COOH, -CO-NH-alanyl, -CONH(C₂₋₄)alkylN(C₁₋₆alkyl)₂, -CONH(C₂₋₄) alkyl-Het, -CONH(C₂₋₄) alkyl-(COOH)-Het, -CONH(C₁₋₂ alkyl) (OH)(C₁₋₂ alkyl)OH, -CONH(C₁₋₆) alkyl-COOH, -CONH(C₆₋₁₀ aryl), -CONH-Het, -CONH(C₆₋₁₀) aryl-COOH, -CONH(C₆₋₁₀) aryl-COO(C₁₋₆) alkyl, -CONH(C₁₋₆) alkyl-COO(C₁₋₆) alkyl, -CONH(C₆₋₁₀) aryl-(C₁₋₆)alkyl-COOH, and -CONH(C₆₋₁₀) aryl-(C₂₋₆)alkenyl-COOH;

or a salt thereof;

said probe comprises a detectable label, whereby said probe binds to an HCV

polymerase or an analog thereof and is capable of being displaced by an inhibitor thereof.

Labels incorporated into the probe may be paired with appropriate labels attached to the tagged NS5B polymerase such that the close proximity of the two pairs of labels upon probe-polymerase association results in a measurable signal; examples of such detection techniques include, but are not limited to, fluorescence resonance energy transfer (FRET), and time resolved fluorescence (TRF).

Preferably, the detectable label is selected from the group consisting of: a fluorescent label (such as fluorescein, Oregon green, dansyl, rhodamine, Texas-red, phycoerythrin or Eu^{3+}), a radioactive atom (such as ^3H , ^{14}C , ^{125}I), a chemiluminescent label (such as luciferase), colorimetric produced by an enzymatic marker (such as β -galactosidase or horseradish peroxidase).

Alternatively, a fluorescent reporter and quencher may be used as pair of labels to monitor association of the probe with the HCV NS5B polymerase. Commonly known reporter/quencher pair may be selected from, for example: EDANS/DABCYL, tryptophan/2,4-dinitrophenyl, tryptophan/DANSYL, 7-methoxycoumarin/2,4-dinitrophenyl, 2-aminobenzoyl/2,4-dinitrophenyl and 2-aminobenzoyl/3-nitrotyrosine.

As will be readily understood by a person skilled in the art, a radioactive label can be incorporated within the probe of formula I at any suitable position. For example, a ^3H , or ^{14}C isotope can replace any hydrogen or carbon present in the molecule. Similarly, a ^{125}I isotope can be substituted on any aromatic ring.

In principle, these tracer methodologies can easily be adapted for the purpose of high-volume screening. Scintillation proximity assay (SPA) methods for radioactive detection have been developed which do not require a separation step and are easily adapted for robotics and microtiter plate format.

Preferably, the detectable label is a fluorescent label or a chemiluminescent label. More preferably, the label is a fluorescent label. Most preferably, the detectable label is a fluorescein.

Non-radioactive detection methods have become increasingly widespread in screening assay because of the costs associated with radiolabeled reagents and their disposal. Fluorescence spectroscopy is one of the most prevalent non-

radioactive detection methods. One type of assay in which fluorescence may be used is fluorescence polarization. Polarization is independent of total fluorescence intensity; therefore, this technique may not be as prone to interference as fluorescence amplitude measurements. As disclosed herein, the new type of assay developed uses a fluorescein-labeled inhibitor, though other fluorescent labels or non-fluorescent techniques can also be applied.

Preferably, the polymerase used in the assay may comprise an affinity tag by which the polymerase can be attached to a solid support, and the probe may be labeled so as to provide a detectable signal. An affinity tag incorporated into the probe may be a biotin that is used to indirectly measure the association of this biotinylated probe to the NS5B polymerase through the secondary use of an avidin-coupled detection technique.

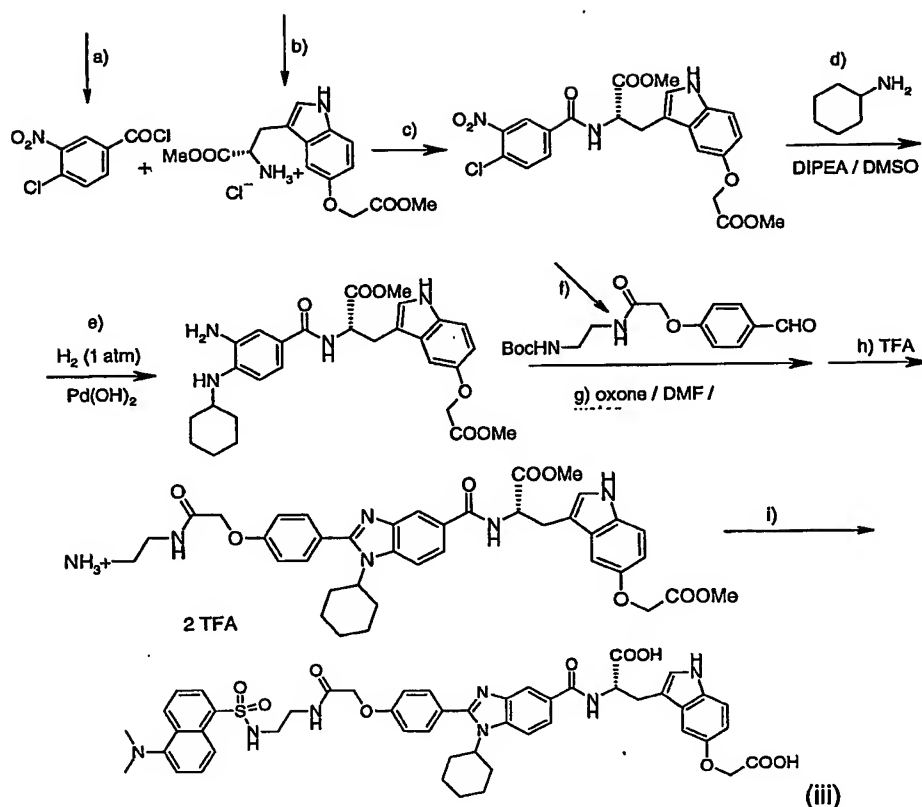
Preferably, the HCV polymerase used in the present assay is selected from the group consisting of: NS5B; NS5BΔ21; NS5BΔ57 or analogs thereof from a variety of genotypes including HCV-1a or 1b strains having optionally a histidine tag at either the N- or C-terminal. Particularly, as will be understood by a person skilled in the art, this binding assay does not require the polymerase activity of the NS5B to be optimal or functional for such a binding assay to perform according to the invention.

EXAMPLES

Example 1A)

probe (iii): (S)-3-(5-Carboxymethoxy-1H-indol-3-yl)-2-({1-[1-cyclohexyl-2-(4-{{2-(5-dimethylamino-naphthalene-1-sulfonylamino)-ethylcarbamoyl]-methoxy}-phenyl)-1H-benzimidazol-5-yl]-methanoyl}-amino)-propionic acid

52



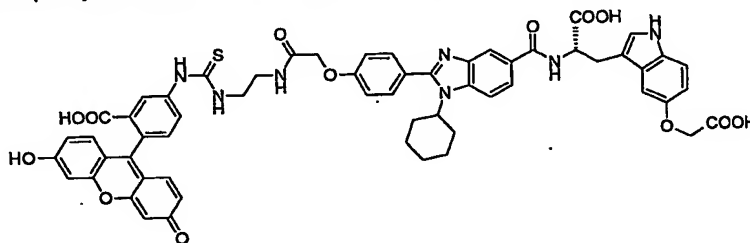
- 5 **a)** 4-Chloro-3-nitrobenzoic acid (40.40 g, 0.20 mole) was suspended in DCM (100 mL) containing 3 drops of DMF. Oxalyl chloride (1.5 equivalents, 0.3 mole, 27 mL) was added in small portions and the mixture stirred overnight at room temperature. After refluxing for an additional hour to complete the reaction, volatiles were removed under reduced pressure and the residue was co-evaporated twice with
- 10 hexane to give the title compound as a light yellow solid.
- b)** (S)-5-Hydroxytryptophan methyl ester hydrochloride (1.55 g, 5 mmol) was dissolved in 80% aqueous MeCN (25 mL) and the solution cooled in ice. Sodium bicarbonate (0.850 g, 10 mmol) was added followed by di-*tert*-butyldicarbonate (1.10 g, 5.1 mmol). The mixture was stirred for 2 h at room temperature, poured into water
- 15 (200 mL) and extracted with EtOAc (3 X). The combined extracts were washed with water and brine, dried (MgSO₄) and concentrated to give a beige solid (1.65 g). The crude product from above (1.50 g, 4.83 mmol) was dissolved in acetone (20 mL) and anhydrous potassium carbonate (1.5 g, 11 mmol) and methyl bromoacetate (0.76 g, 5 mmol) were added. The mixture was reflux for 4 h after which point
- 20 additional methyl bromoacetate was added to complete the reaction (15 mg portions

- until complete by HPLC). The reaction mixture was then cooled and filtered to remove solid. Evaporation of the filtrate gave the desired carbamate as an oil (2.0g). The crude carbamate from above (2.0 g) was deprotected by stirring with 4N HCl – dioxane for 1 h at room temperature. Removal of volatiles in *vacuo* gave the desired
- 5 tryptophan ester derivative as a tan-colored solid (1.51 g).
- c) The tryptophan derivative from step b) (0.343 g, 1 mmol) was dissolved in 80% aqueous MeCN (10 mL) and sodium bicarbonate (3 equivalents, 0.260 g) was added. The solution was cooled in ice and 4-chloro-3-nitrobenzoyl chloride from step a) (0.220 g, 1 mmol) was added. The mixture was stirred for one hour at room
- 10 temperature, concentrated under reduced pressure and the residue purified by flash chromatography (1:2 hexane / EtOAc as eluent) to give compound c) as a yellow foam (0.391 g).
- d) The 4-chlorobenzamide derivative from above (0.214 g, 0.45 mmol) was dissolved in DMSO (1 mL) and DIEA (0.2 mL) was added followed by
- 15 cyclohexylamine (3 equivalents, 0.16 mL). The mixture was stirred at 60-65 °C for 4 h and subsequently diluted with water. The orange precipitate that formed was collected, washed with water and dried (0.200 g).
- e) The crude material from above (0.200 g, 0.36 mmol) was hydrogenated (1 atm H₂) over 20% Pd(OH)₂ on charcoal (60 mg) in MeOH (15 mL). After 2 h, the suspension
- 20 was filtered to remove the catalyst and concentrated *in vacuo* to give the title compound as a foam (0.16 g).
- f) 4-Formylphenoxyacetic acid (0.306 g, 1.70 mmol) was dissolved in DCM (5 mL). DIEA (0.524 g, 4 mmol) and TBTU (0.550 g, 1.70 mmol) were added followed by *tert*-butyl *N*-(2-aminoethyl)carbamate (0.250 g, 1.56 mmol). The mixture was stirred
- 25 2 h at room temperature, dissolved in EtOAc and washed sequentially with 5% aqueous K₂CO₃, KHSO₄, water and brine. The extract was dried (MgSO₄) and concentrated under reduced pressure to give a yellow solid (0.350 g).
- g) The diamine derivative from step e) (0.026 g, 0.05 mmol) and aldehyde from step f) (0.020 g, 0.06 mmol) were dissolved in DMF (0.3 mL) and water (0.03 mL) was
- 30 added followed by oxone® (0.024 g, 0.04 mmol). The mixture was stirred 1 h at room temperature and then diluted with water. The resulting precipitate was collected by filtration, washed with water and dried to give a beige solid (0.020 g).
- h) The crude carbamate from above was stirred with TFA for 30 min at room temperature. Volatiles were removed under reduced pressure and the residue was
- 35 purified by preparative C18 reversed-phase HPLC to give the bis TFA salt.

- i) The amine salt (0.019 g, 0.02 mmol) was dissolved in DMSO (0.3 mL) and DIEA (0.06 mL) was added followed by dansyl chloride (0.065 g, 0.02 mmol). The mixture was stirred for 1 h at room temperature. 5N NaOH (0.12 mL) and water (0.05 mL) were added and the saponification was allowed to proceed for 1 h at room temperature. Following acidification with TFA, the probe (iii) was directly isolated from the reaction mixture by preparative C18 reversed-phase HPLC: MS (ES+) m/z 930 (MH+).

Example 1B)

- probe (ii): 5-(3-{2-[2-(4-{5-[(S)-1-Carboxy-2-(5-carboxymethoxy-1H-indol-3-yl)-ethylcarbamoyl]-1-cyclohexyl-1H-benzimidazol-2-yl]-phenoxy)-ethanoylamino]-ethyl}-thioureido)-2-(6-hydroxy-3-oxo-3H-xanthen-9-yl)-benzoic acid

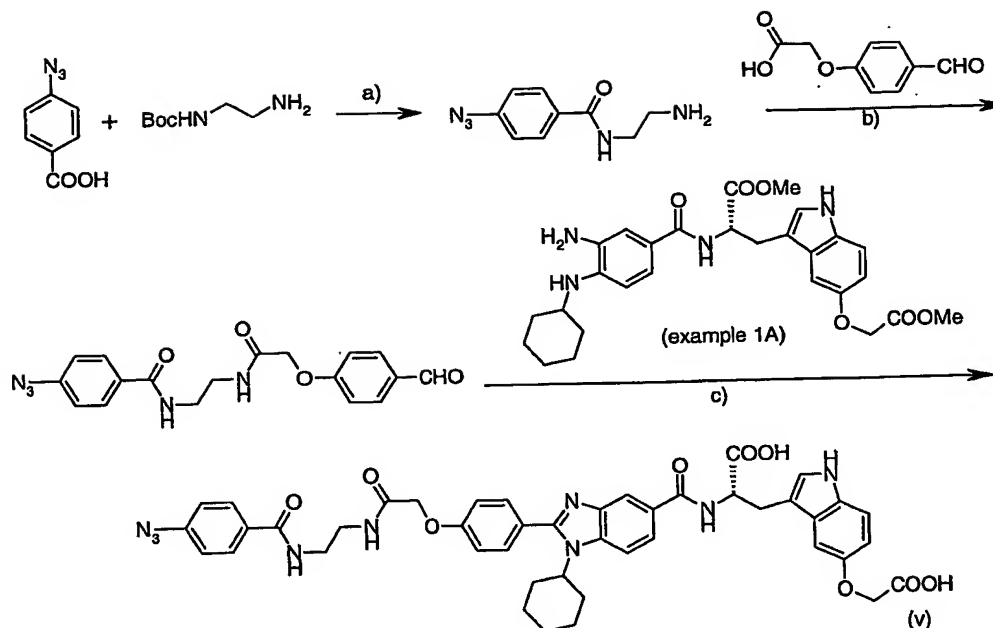


- The amine salt from step h) of Example 1A (0.06 mmol) was dissolved in DMSO (0.6 mL) and DIEA (0.3 mL) was added followed by fluorescein isothiocyanate isomer 1 (0.026 g, 0.066 mmol). The mixture was stirred for 1 h at room temperature. 5N NaOH (0.3 mL) and water (0.15 mL) were added and stirring resumed for an additional 30 min. Following acidification with TFA, probe (ii) was isolated directly by preparative C18 reversed-phase HPLC: MS (ES+) m/z 1086 (MH+).

Example 1C)

- probe (v): (S)-2-[[1-(2-{4-[[2-[[1-(4-Azido-phenyl)-methanoyl]-amino]-ethylcarbamoyl]-methoxy]-phenyl]-1-cyclohexyl-1H-benzimidazol-5-yl)-methanoyl]-amino]-3-(5-carboxymethoxy-1H-indol-3-yl)-propionic acid

55



a) 4-Azidobenzoic acid (0.160 g, 1 mmol) was dissolved in DCM (3 mL). DIEA (0.5 mL, 2.5 mmol) and TBTU (0.337 g, 1.05 mmol) were added followed by *tert*-butyl *N*-(2-aminoethyl)carbamate (0.165 g, 1.03 mmol). The mixture was stirred 2.5 h at room temperature, dissolved in EtOAc and washed sequentially with 5% aqueous K_2CO_3 , KHSO_4 , water and brine. The extract was dried (MgSO_4) and concentrated under reduced pressure to give a yellow solid (0.257 g). The crude carbamate (0.257 g, 0.84 mmol) was deprotected by stirring in 4N HCl – dioxane (15 mL) for 2 h at room temperature. Volatiles were removed under reduced pressure to give a pinkish solid.

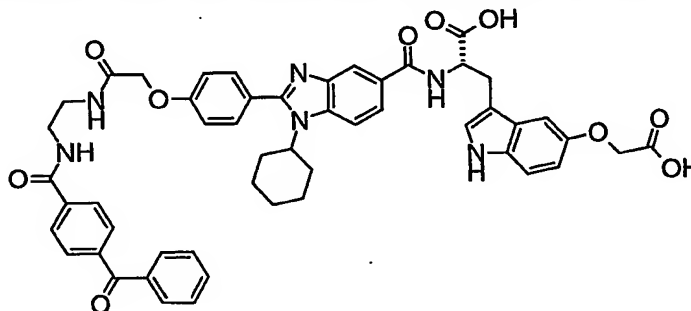
b) 4-Formylphenoxyacetic acid (0.200 g, 1.1 mmol) was dissolved in DCM (3 mL) and DIEA (0.5 mL) was added followed by TBTU (0.350 g, 1.1 mmol) and the amine salt from above (0.240 g, 1 mmol). The mixture was stirred 4 h at room temperature, dissolved in EtOAc and washed sequentially with 5% aqueous K_2CO_3 , KHSO_4 , water and brine. The extract was dried (MgSO_4) and concentrated under reduced pressure to give an off-white solid (0.162 g).

c) The benzaldehyde derivative from above (0.044 g, 0.12 mmol) and the diamine derivative from step e) of Example 1A (0.052 g, 0.1 mmol) were dissolved in DMF (0.6 mL) and water (0.1 mL). Oxone® (0.050 g, 0.8 mmol) was added and the mixture stirred for 1 h at room temperature. 5N NaOH (0.2 mL) and water (0.1 mL) were added and saponification allowed to proceed for 1 h. Probe (v) was isolated

directly by preparative C18 reversed-phase HPLC (12.5 mg): MS (ES+) m/z 842 (MH+).

Example 1D)

- 5 *probe (vi): (S)-3-(5-Carboxymethoxy-1H-indol-3-yl)-2-({1-[1-cyclohexyl-2-(4-[[2-({1-[4-(1-phenyl-methanoyl)-phenyl]-methanoyl)-amino)-ethylcarbamoyl]-methoxy}-phenyl]-1H-benzimidazol-5-yl]-methanoyl)-amino}-propionic acid*

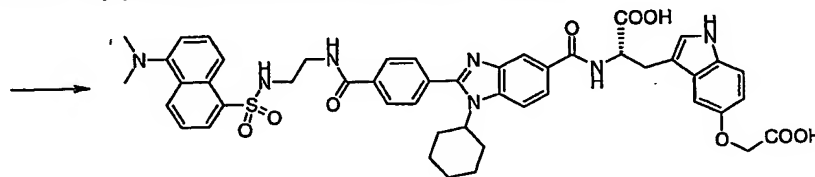


(vi)

- Following the procedures described for probe (v) in Example 1C but using 4-benzoylbenzoic acid instead of 4-azidobenzoic acid, probe (vi) was obtained: MS (ES+) m/z 905 (MH+).

Example 1E)

- 15 *probe (iv) (S)-3-(5-Carboxymethoxy-1H-indol-3-yl)-2-[[1-(1-cyclohexyl-2-(4-[2-(5-dimethylamino-naphthalene-1-sulfonylamino)-ethylcarbamoyl]-phenyl)-1H-benzimidazol-5-yl)-methanoyl]-amino}-propionic acid*



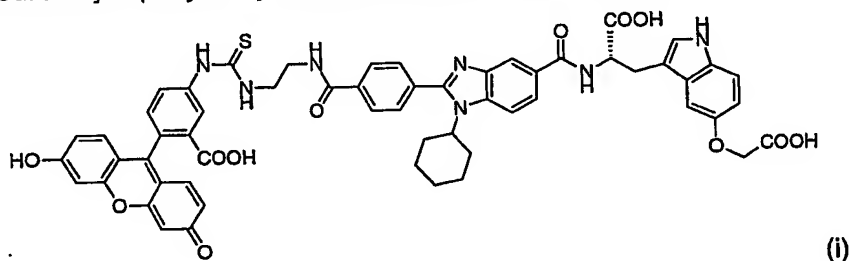
(iv)

- a) Following the procedures described for step f) in Example 1A, 4-carboxybenzaldehyde was coupled to *tert*-butyl *N*-(2-aminoethyl)carbamate.
- 20 b) Following benzimidazole ring formation with the diamine derivative of Example 1A step e) and the aldehyde from above using oxone® as described in Example 1A step g), the Boc protecting group was removed and the resulting amine condensed with dansyl chloride as described in Example 1A step i).

c) Probe (iv) was obtained following saponification of the ester groups under the usual conditions and isolation by preparative C18 reversed-phase HPLC: MS (ES+) m/z 900 (MH+).

5 Example 1F)

(probe (i):5-[3-(2-[[1-(4-{5-[(S)-1-Carboxy-2-(5-carboxymethoxy-1H-indol-3-yl)-ethylcarbamoyl]-1-cyclohexyl-1H-benzimidazol-2-yl]-phenyl)-methanoyl]-amino]-ethyl)-thioureido]-2-(6-hydroxy-3-oxo-3H-xanthen-9-yl)-benzoic acid



10 The procedure described for Example 1E) was used except that fluorescein isothiocyanate isomer 1 was used instead of dansyl chloride. Probe (i) was obtained after purification by preparative C18 reversed-phase HPLC: MS (ES+) m/z 1056 (MH+).

15 Example 2

Production and purification of HCV NS5B polymerase Δ21-His

The recombinant HCV NS5B polymerase can be produced in soluble form by expression of a variant that lacks the C-terminal 21 amino acids normally found on the mature NS5B (Yamashita *et al.* 1998, J. Biol. Chem. 273:15479-15486; Ferrari *et al.*, 1999, J. Virol. 73: 1649-1654). We have expressed this so called NS5BΔ21 with a C-terminal hexa-histidine (termed NS5BΔ21-His; SEQ ID. NO. 1) and with an N-terminal hexa-histidine tag (termed His-NS5BΔ21; SEQ ID NO. 2) (either proteins being referred to as "his-tag NS5B"). Expression of these genes from pET vectors in *E. coli* strain JM109 (DE3) is induced with 0.4 mM IPTG for 3 hours at 22 °C. Cells are harvested and lysed in a microfluidizer in lysis buffer (Tris-HCl pH 7.5, 10 % glycerol, 1 mM EDTA, 2 mM 2-mercaptoethanol, 500 mM NaCl, 1 mM PMSF, 1 μg/ml antipain, 1 μg/ml pepstatin A and 1 μg/ml leupeptin). The lysate is clarified by a 30 000 g centrifugation and then supplemented with imidazole to final concentration of 10 mM. The lysate is then loaded onto a metal-chelating resin (Ni-NTA; Qiagen) previously equilibrated with buffer A (Tris-HCl pH 7.5, 10 % glycerol,

58

500 mM NaCl, 10 mM imidazole), washed extensively and then the protein is eluted with gradient of buffer A containing 500 mM imidazole. Peak fractions containing the his-tag NS5BΔ21 are pooled and diluted with buffer C (20 mM Tris-HCl pH 7.5, 10 % glycerol, 5 mM DTT) to reduce the NaCl concentration to 300 mM and then applied
5 to a DEAE-Sepharose column to remove any nucleic acid. The flow-through from the DEAE-Sepharose column is diluted with buffer C to reduce the NaCl to 200 mM and then applied to a heparin-Sepharose column. The his-tag NS5B is eluted from the heparin-Sepharose in buffer C with a 200 mM to 1 M NaCl gradient. Peak fractions containing the his-tag NS5B are pooled and diluted with buffer C to achieve a final
10 NaCl of 200 mM and loaded onto a Resource S column. Concentrated His-tag NS5B is eluted from the resource S, loaded and size fractionated on a Superdex 200 column in buffer C containing 300 mM NaCl. Peak fractions contain highly pure his-tag NS5B and are stored at -80 °C until use.

15 **Example 3**Fluorescence anisotropy analysis

Titration of the probe with the enzyme was performed as follows:

The fluorescein labeled probe was diluted to the desired concentration in 20 mM Tris-HCl pH 7.5, 1mM EDTA, 5 mM MgCl₂, 1 mM DTT and 10% DMSO. The
20 NS5BΔ21-His protein was serially diluted in 25 mM Tris-HCl pH 7.5, 300 mM NaCl, 5 mM DTT, 1 mM EDTA, 30% glycerol and 0.1% IGEPAL. Total volume of the reaction was 500 μL and final assay buffer was 20 mM Tris-HCl pH 7.5, 1 mM EDTA, 5 mM MgCl₂, 1 mM DTT, 30 mM NaCl, 3% glycerol, 0.01% IGEPAL and 5% DMSO. Anisotropy measurements were performed on a SLM Aminco 8100
25 Spectrofluorometer equipped with a 450-W xenon arc lamp and a T-optics configuration. Excitation wavelength was at 493 nm and emission was monitored at 530 nm. In each anisotropy measurement, the parallel and perpendicular intensities of the background buffer solution was subtracted from the measured values of the sample and the anisotropy was calculated. Data were processed on SAS program
30 (SAS Institute Inc., NC, USA) for a non linear regression to obtain the direct binding equilibrium constant and other parameters, and the plot of the regressed fit over the experimental data. An example of a titration curve obtained with probe (i) is shown on Figure 1. K_d values for probes (i) and (ii) with the polymerase were respectively of 15 nM and 6 nM.

Example 4**96-well plate Polarization assay**

To obtain K_d values of different compounds competing with these probes (test compounds), this assay was transformed to a more amenable format and a binding assay was made suitable for a 96-well microplate reader. The probe was diluted in order to obtain the desired final concentration (from 4 to 25 nM, depending on its K_d towards the enzyme and on the conditions of the assay). The tested compounds were serially diluted by a factor of 2 or 3-fold in 20 mM Tris-HCL pH 7.5, 1 mM EDTA, 5 mM $MgCl_2$, 1 mM DTT and 15% DMSO. The NS5B Δ 21-His concentration in the assay was calculated to obtain 70% of binding of the probe; these conditions allowed for the displacement of the probe by test compounds. The assay reactions finally contained 50 μ L of the serial dilutions of the tested compounds that were transferred in 96-well black plates (Packard); a complete row was however free of compound to obtain a positive control value and verify real percent of bound probe in the experiment. 50 μ L of the probe were then added to each well, except in one column for blank subtraction. Lastly, 150 μ L of enzyme were added to all wells, except in one row, which was used to determine the 0% and 100% bound values. In this row of 8 wells, enzyme buffer was added to the first 4 wells (to determine the anisotropy value of the free probe or r_f) and a 10-fold excess of the concentration of the enzyme used in the assay was added to the other 4 wells (to determine the anisotropy value when 100% of the probe is bound i.e. the r_b value). These values were required to calculate the K_d values. The final buffer conditions of the assay were identical to the ones used for K_d determination of the probes, i.e. 20 mM Tris-HCl pH 7.5, 1 mM EDTA, 5 mM $MgCl_2$, 1 mM DTT, 30 mM NaCl, 3% glycerol, 0.01% IGEPAL and 5% DMSO. The reactions were incubated for 90 minutes at room temperature in the dark. Readings of polarization were then performed on a POLARstar Galaxy, equipped with a high-energy xenon flash lamp, using an excitation filter of 485 nm and an emission filter of 520 nm. Polarization values can be converted easily to anisotropy values with the following calculation (Owicki *et al.*, 2000, J. Biomol. Screen. 5:297-306):

$$a = 2 \times P / (3 - P) \text{ where}$$

a: anisotropy value

P: Polarization value

Anisotropy values can then be used to obtain two types of results fitted to SAS nonlinear regression analysis to obtain apparent K_d values, using for the calculations as positive control the anisotropy value at ~ 70% binding, and as negative control the anisotropy value of the free probe (r_f);

5 fitted to the Anisotropy equation:

$$a = \frac{(-K_d - I + E_o) + \sqrt{((K_d + I - E_o)^2 + 4 * K_d * E_o)}}{2 \left[\frac{(a * Q * r_b + K_p * r_f)}{(K_p + a * Q)} \right]}$$

where a: anisotropy

K_d : dissociation constant for the inhibitor

I: Concentration of compound (or inhibitor) tested

10 E_o : NS5B concentration (E_o has to be \gg [probe])

$Q = Q_b/Q_f$ = total fluorescence for probe 100% bound/ total fluorescence
for free probe

r_b : anisotropy value when the probe is 100% bound

r_f : anisotropy value when the probe is free

15 K_p : dissociation constant for the probe

This high throughput assay was evaluated and validated by the determination of the statistical parameter Z' (J.-H. Zhang *et al.*, 1999, J. of Biomol. Screening, 4:67-73). Results of this experiment are illustrated on Figure 2. The anisotropy values for a series of positive and negative controls were very similar, resulting in very low standard deviations; 0.2186 ± 0.0036 A units for the positive controls and 0.0738 ± 0.0037 A units for the negative controls. The Z' value obtained for the assay was of 0.85, implying that we have excellent conditions to detect compounds that would compete with the probe.

25

Example 5

Inhibitor testing

We have identified potent compounds that can effectively displace the probe in this binding assay. Figures 3 and 4 show examples of some of them, with K_d values ranging from 31 nM to 1 μ M. The anisotropy equation was defined in the Grafit Software (Erithacus Software Ltd., UK) and plotted such that inhibitor concentration was the X-variable and anisotropy was the Y variable; parameters calculated by the

30

software were the inhibitor K_d and Q_b/Q_f ratio. Supplied constants were the K_p , E_0 , r_b and r_f .

Example 6

5 Modified conditions for the Polarization assay

The usefulness of this polarization assay is evident when binding of compounds has to be studied under different conditions. For example, binding constants of the probes have been determined at different concentrations of salts and pH. Figures 5 to 8 show the binding curves of probe (i) in final NaCl concentrations ranging from 30 mM to 200 mM. All other reagents in the assay were as described in the standard protocol (Example 3). As shown on these Figures, K_d values gradually increase with salt concentration from $K_d=15$ nM (at 30 mM NaCl) to $K_d=122$ nM (at 200 mM NaCl). Studies at pH 6.5 were also performed to determine the K_d of the probe (i) at lower pH. For these assays, 20 mM Phosphate buffer pH 6.5 was used in place of Tris; all other reagents of the assay were as described in the 96-well Polarization assay (Example 4). An example of these types of experiments is shown in Figure 9. The K_d value obtained at pH 6.5 with probe (i) was of 33 nM. Having established these K_d values under different experimental conditions, it is then trivial to determine what concentrations of probe and enzyme should be used to obtain 70% of binding of the probe with the equilibrium equation. Once these values are obtained, compounds of interest can easily be studied under the new conditions to determine their K_d values.

Example 7

Fluorescence Polarization assay with a modified enzyme

25 The Fluorescence polarization assay was also used with other constructs of our HCV polymerase enzyme. In addition to the C-terminally tagged NS5B Δ 21-His polymerase, the NS5B enzyme with the His-tag at the N-terminal position was also used in the fluorescence polarization assay. Determination of the K_d for the probe (i) with this enzyme was performed, using the same conditions described in the standard 96-well format assay. Figure 10 shows that the K_d obtained with probe (i) was similar, i.e. 18 nM. A comparison was made between the IC_{50} and the K_d for three compounds, using these two different constructs of the enzymes (NS5B Δ 21-His and His-NS5B Δ 21).

IC₅₀'s are determined using the Scintillation Proximity Assay (SPA) according to the following assay:

The substrates are: (i) a 12 nucleotide RNA oligo-uridylate (or oligo-uridine-monophosphate) (oligo-U) primer modified with biotin at the free 5'C position; (ii) a
5 complementary poly-adenylate (or adenosine monophosphate) (polyA) template of heterogeneous length (1000-10000 nucleotides); and (iii) UTP-[5,6 ³H]. Polymerase activity is measured as the incorporation of UMP-[5,6 ³H] into the chain elongated from the oligo-U primer. The ³H-labelled reaction product is captured by SPA-beads coated with streptavidin and quantified on the TopCount (Packard). Inhibitors are
10 tested at various concentrations in a reaction containing: 1 to 5 nM of the his-tagged NS5B, 1 µg/ml of biotinylated oligo U primer, 10 µg/ml of polyA template, 20 mM Tris-HCl pH 7.5, 5 mM MgCl₂, 25 mM KCl, 1 mM EDTA, 1 mM DTT, 0.33 % n-dodecyl maltoside, 5% DMSO, 0.0083 µCi/µl [0.25 µM] UTP-[5,6-³H], 0.75 µM UTP, 1.67 U/ µl RNAsinTM. The reaction was incubated at room temperature for 1.5 hours.
15 STOP solution (20 µl; 0.5 M EDTA, 150 ng/ µl tRNA) was added, followed by 30 µl streptavidin coated PVT beads (8mg/ml in 20 mM Tris-HCl, pH 7.5, 25 mM KCl, 0.025% NaN₃). The plate was then shaken for 30 minutes. A solution of CsCl was added (70 µl, 5 M), to bring the CsCl concentration to 1.95 M. The mixture was then allowed to stand for 1 hour. The beads were then counted on a Hewlett Packard
20 TopCountTM instrument. Based on the results at ten different concentrations of test compound, standard concentration-% inhibition curves were plotted and analysed to determine IC₅₀'s for the compounds.

Results of this experiment are illustrated in Table I. The K_d values were similar with
25 both enzymes for the three compounds tested, whereas the IC₅₀ values obtained with the two enzymes show significant differences and reflect the differences in substrate affinity.

Example 8

30 Specificity of the Fluorescence Polarization assay

The utility of the Fluorescence polarization assay was examined with another distantly related viral polymerase and with a closely related genotype (1a) HCV polymerase.

The GBV-B polymerase enzyme (termed GBV-BΔ23-His; **SEQ ID NO. 3**) (Simons,

J.N. *et al.*, 1995, Proc. Natl. Acad. Sci. USA 92, 3401-3405; Bukh, J. *et al.*, 1999, Virology 262, 470-478) was produced and purified as described in Example 2 with the following modifications:

Expression of the gene from pET vectors in *E. coli* strain JM109 (DE3) was induced
5 with 0.5 mM IPTG for 3 hours at 22 °C. Cells were harvested and lysed in a
microfluidizer in buffer A (Tris-HCl pH 7.5, 10 % glycerol, 1 mM EDTA, 2 mM 2-
mercaptoethanol, 500 mM NaCl, 1 mM PMSF, 1 ug/ml antipain, 1 ug/ml pepstatin A ,
1 ug/ml leupeptin and 0.5% dodecyl- β -D-maltoside). The lysate was clarified by a 30
000 g centrifugation and then supplemented with imidazole to a final concentration of
10 10 mM. The lysate was then loaded onto a metal-chelating resin (Ni-NTA; Qiagen)
previously equilibrated with buffer A containing 10 mM imidazole, washed
extensively and then the protein was eluted with a gradient of buffer A containing
500 mM imidazole. Peak fractions containing the his-tag GBV-B Δ 23 were pooled
and diluted with buffer C (20 mM Tris-HCl pH 7.5, 10 % glycerol, 5 mM DTT, 0.01%
15 dodecyl- β -D-maltoside) to reduce the NaCl concentration to 300 mM and then
applied to a DEAE-Speharose column to remove any nucleic acid. The flow-through
from the DEAE-Speharose column was diluted with buffer C to reduce the NaCl to
200 mM and then applied to a heparin-Sepharose column. The his-tag GBV-B was
eluted from the heparin-Sepharose in buffer C with a 200 mM to 1 M NaCl gradient.
20 Peak fractions containing the pure his-tag GBV-B were then pooled and stored at -
80 °C until use.

The HCV genotype 1a NS5B polymerase [termed His-NS5B Δ 21(H77c,1a); **SEQ ID**
NO. 4] (Yanagi, M. *et al.*, 1997, Proc. Natl. Acad. Sci. USA 94, 8738-8743) was
25 produced and purified as described in Example 2 with the following modifications:

Expression of the gene from pET vectors in *E. coli* strain JM109 (DE3) was induced
with 0.4 mM IPTG for 3 hours at 22 °C. Cells were harvested and lysed in a
microfluidizer in buffer A (Tris-HCl pH 8.0, 10 % glycerol, 1 mM EDTA, 2 mM 2-
30 mercaptoethanol, 500 mM NaCl, 1 mM PMSF, 1 ug/ml antipain, 1 ug/ml pepstatin A,
1 ug/ml leupeptin, 1% dodecyl- β -D-maltoside, 1% Triton X-100 and 0.1% CHAPS).
The lysate was clarified by a 30 000 g centrifugation and then supplemented with
imidazole to a final concentration of 10 mM. The lysate was then loaded onto a
metal-chelating resin (Ni-NTA; Qiagen) previously equilibrated with buffer A
35 containing 10 mM imidazole, 0.1% NP-40, without CHAPS, and with lower

concentrations of the other detergents (0.2% dodecyl- β -D-maltoside, 0.05% Triton X-100); after extensive washing, the protein was eluted with a gradient of buffer A containing 500 mM imidazole. Peak fractions containing the his-tag NS5B Δ 21(H77c,1a) were pooled and diluted with buffer C (20 mM Tris-HCl pH 8.0, 10 % glycerol, 5 mM DTT, 0.2% dodecyl- β -D-maltoside) to reduce the NaCl concentration to 300 mM and then applied to a DEAE-Sepharose column to remove any nucleic acid. The flow-through from the DEAE-Sepharose column was diluted with buffer C to reduce the NaCl to 200 mM and then applied to a heparin-Sepharose column. The his-tag NS5B Δ 21(H77c,1a) was eluted from the heparin-Sepharose in buffer C with a 200 mM to 1 M NaCl gradient. Peak fractions containing the polymerase were then pooled and diluted with buffer C to achieve a final NaCl of 200 mM and loaded onto a Resource S column. Peak fractions containing the his-tag NS5B(H77c,1a) were pooled, loaded and size fractionated on a Superose 12 column in buffer C containing 600 mM NaCl. Peak fractions contain highly pure his-tag NS5B were pooled and stored at -80°C until use.

The GBV-B and the HCV 1a polymerases were used to titrate probe ii, using the protocol described in Example 3. Figures 11 and 12 show the titration curves observed with the GBV-B polymerase and the NS5B(H77c,1a) polymerase, respectively. The K_d value of probe ii for the GBV-B enzyme was 1.8 μM (estimated value with an incomplete curve and an r_b value of 0.21), illustrating the weak binding of the probe to this distantly related polymerase. In contrast, the K_d for the HCV 1a polymerase was 18 nM, revealing that the 1a genotype enzyme binds probe ii with the same affinity as the HCV 1b genotype polymerase.

K_d values for a series of compounds were determined with these two HCV (genotypes 1a and 1b) polymerases, using the assay format described in Example 4.

Results of this experiment are illustrated in Table 2. These results show that the K_d values for this series of inhibitors are in the same range with the two genotypically related HCV enzymes.

TABLE 1

Comparison of compound K_d and IC_{50} values with two different HCV NS5B polymerases

Cpd	K_d value (nM)		IC_{50} value (nM)	
	NS5B Δ 21-His	His-NS5B Δ 21	NS5B Δ 21-His	His-NS5B Δ 21
X	44	41	867	66
Y	22	31	348	68
Z	92	88	735	34

TABLE 2

Comparison of compound K_d values with NS5B polymerases from two HCV genotypes

Cpd	K_d values (nM)	
	His-NS5B Δ 21(1b)	His-NS5B Δ 21(H77c,1a)
A	2.7	1.8
B	12	8.0
C	5.3	7.2
D	3.5	7.1
E	2.4	2.7

DISCUSSION

The HCV NS5B polymerase is a prime target in the search for inhibitors of HCV replication. The HCV NS5B enzymatic activity has been studied *in vitro* with a variety of RNA substrates (Behrens et al., 1996; and many references thereafter). Different preparations of the HCV polymerase exhibit varying efficiencies of product formation with a variety of RNA substrates. Estimations are that only a small fraction (i.e. < 1%) of the common preparations of purified recombinant HCV NS5B polymerase interact

with RNA substrate to reconstitute processive RNA product synthesis (Carroll SS, *et al.*, 2000. Biochemistry, 39:8243-8249). Moreover, the activity of purified recombinant NS5B polymerase varies significantly with specific RNA substrates; a characteristic that presumably reflects the capability of the NS5B of forming productive replication-competent complexes with these substrates (Zhong W, *et al.*, 2000, J Virol, 74, 9134-9143).

In an effort to overcome the limitations of HCV polymerase assays that use sub-optimal and poorly characterized RNA substrates, the Applicants have developed an assay for specific inhibitors of the HCV polymerase that is independent of the presence of RNA. The assay is based upon the use of a characterized inhibitor specific for the HCV polymerase. In the examples presented above, the inhibitor was labeled with a fluorescein moiety and the interaction of this probe with the NS5B was measured and quantified by fluorescence polarization. However, the interaction can also be measured by the use of a radiolabel, or other common labels placed on the inhibitor and applying common techniques for assessing the association of the labeled probe with an appropriately tagged target HCV polymerase. Binding equilibrium with the fluorescein labeled probe is clearly evident in Example 3, as the fraction of bound probe increased with the amount of HCV polymerase. An HCV polymerase assay with components at equilibrium is an advantage over previous assays with RNA substrates, as the active HCV polymerase that stably associates with RNA substrates in processive complexes does not readily dissociate (Carroll SS, *et al.*, 2000 Biochemistry, 39:8243-8249; Zhong W, *et al.*, 2000 J Virol, 74, 9134-9143; Tomei L, *et al.* 2000 J Gen. Virol. 81, 759-767.). Though these labeled probes readily dissociate from the HCV polymerase, they do so with low nM dissociation constants and provide the required sensitivity (in the low nM range) to detect potent and specific inhibitors. The assay format is adaptable to screening in 96-well (or higher density) plate format as demonstrated in Example 4. A particular advantage of this high throughput screening format is the extremely stable signal and minimal well-to-well variation that the assay provides, particularly in a convenient non-radioactive format. Specific inhibitors of the HCV polymerase were identified and potencies easily determined with this assay (Figures 3 and 4).

The direct binding assay described herein overcomes other limitations of the enzymatic HCV polymerase assay. The *in vitro* RNA polymerase activity of NS5B is

extremely sensitive to ionic strength, and KCl or NaCl concentrations exceeding 100 mM inhibit the reaction (Lohmann V, *et al.*, 1998 Virology 249, 108-118; Luo G, *et al.*, 2000, J Virol., 74, 851-63.) Hence the ability to determine the potency of inhibitors at various salt concentrations is restricted by this limitation of standard enzymatic reactions. The direct binding assay of this invention is amenable to adjustments in salt concentration or pH levels as demonstrated in Example 6. The potencies and interaction of specific inhibitors with the NS5B target can easily be determined under conditions not suitable for enzymatic RNA polymerization studies (such as the absence of divalent cation).

10

Established HCV polymerase enzymatic assays provide IC_{50} values as representative measurements of inhibitor potencies. For inhibitors that are competitive with either RNA or NTP, the IC_{50} value is proportional to the concentration of substrates in the assay and will vary depending on the concentration of these components. The assay described herein permits a direct measurement of inhibitor potencies (reflected by K_d values), under defined conditions, irrespective of the substrate concentration. In enzymatic reactions that use either the N-terminal tag His-NS5B Δ 21 or the C-terminal tag NS5B Δ 21-His, significantly disparate IC_{50} values are obtained for identical compounds assayed under identical conditions. The His-NS5B Δ 21 and NS5B Δ 21-His polymerases have different affinities for the primer/template RNA substrate thereby resulting in the disparate IC_{50} for the identical compounds (Example 7, Table 1). A major advantage that is exemplified by the direct binding assay described in this invention is that these differences are reconciled by the relatively similar K_d values that the individual inhibitors display with the two different HCV polymerases.

25

The direct binding assay described herein has also been shown to be specific for HCV polymerase enzymes. Example 8, in which a K_d at least 100-fold higher for the probe ii was obtained with the GBV-B polymerase, illustrates the weak binding of the probe to this polymerase and the specificity of binding to the HCV polymerases. Moreover, Example 8 also demonstrates that the polymerases from two distinct and clinically relevant HCV genotypes bind the probe with similar affinities.

30

The direct inhibitor-binding assay of this invention alleviates many restrictions of conventional HCV polymerase enzymatic assays described to date. The Applicants have exemplified how the use of a characterized inhibitor as a competitive probe provides a number of improvements and advancements in the search for specific inhibitors of the NS5B polymerase. This assay may accelerate the identification and characterization of candidate therapeutics for the treatment of HCV related diseases.

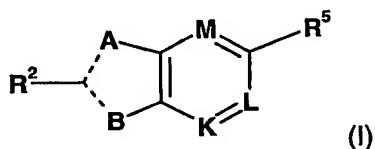
CLAIMS

1. A method for identifying compounds binding to HCV polymerase comprising the steps of:

- a) contacting said HCV polymerase or an analog thereof with a probe being capable of binding to an HCV polymerase or an analog thereof, said probe being displaceable by an inhibitor thereof, so as to form a complex comprising said probe bound to said polymerase;
- b) measuring a signal emitted from said probe in said complex to establish a base line level;
- c) incubating the product of step a) with a test compound; and
- d) measuring the signal from said complex; and
- e) comparing the signal from step d) with the signal from step b);

whereby a modulation in said signal is an indication that said test compound binds to said polymerase.

2. The method according to claim 1, wherein said probe is selected from: an isomer, enantiomer, diastereoisomer, or tautomer of a probe represented by formula I:



wherein A is O, S, N, NR¹, or CR¹, wherein R¹ is selected from the group consisting of: H, (C₁₋₆)alkyl optionally substituted with:

- halogen, OR¹¹, SR¹¹ or N(R¹²)₂, wherein R¹¹ and each R¹² is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-Het, said aryl or Het optionally substituted with R¹⁰; or
- both R¹² are covalently bonded together and to the nitrogen to which they are both attached to form a 5, 6 or 7-membered saturated heterocycle;

----- represents either a single or a double bond;

R² is selected from: H, halogen, R²¹, OR²¹, SR²¹, COOR²¹, SO₂N(R²²)₂, N(R²²)₂, CON(R²²)₂, NR²²C(O)R²² or NR²²C(O)NR²² wherein R²¹ and each R²² is

independently H, (C₁₋₆)alkyl, haloalkyl, (C₂₋₆)alkenyl, (C₃₋₇)cycloalkyl, (C₂₋₆)alkynyl, (C₅₋₇)cycloalkenyl, 6 or 10-membered aryl or **Het**, said **R**²¹ and **R**²² being optionally substituted with **R**²⁰;

or both **R**²² are bonded together to form a 5, 6 or 7-membered saturated heterocycle with the nitrogen to which they are attached;

B is **NR**³ or **CR**³, wherein **R**³ is selected from (C₁₋₆)alkyl, haloalkyl, (C₃₋₇)cycloalkyl, (C₆₋₁₀)bicycloalkyl, 6- or 10-membered aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**, said alkyl, cycloalkyl, bicycloalkyl, aryl, **Het**, alkyl-aryl and alkyl-**Het** being optionally substituted with from 1 to 4 substituents selected from: halogen, or

a) (C₁₋₆)alkyl optionally substituted with:

- **OR**³¹ or **SR**³¹ wherein **R**³¹ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**; or

- **N(R**³²**)**₂ wherein each **R**³² is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**; or both **R**³² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

b) **OR**³³ wherein **R**³³ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**;

c) **SR**³⁴ wherein **R**³⁴ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**; and

d) **N(R**³⁵**)**₂ wherein each **R**³⁵ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl or (C₁₋₆)alkyl-**Het**; or both **R**³⁵ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

with the proviso that when **A** is not N, then one of **A** or **B** is either **CR**¹ or **CR**³;

K is N or **CR**⁴, wherein **R**⁴ is H, halogen, (C₁₋₆)alkyl, haloalkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl; or **R**⁴ is **OR**⁴¹ or **SR**⁴¹, **COR**⁴¹ or **NR**⁴¹**COR**⁴¹ wherein each **R**⁴¹ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl;

or R^4 is $NR^{42}R^{43}$ wherein R^{42} and R^{43} are each independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, or both R^{42} and R^{43} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

5

L is N or CR^5 , wherein R^5 has the same definition as R^4 defined above;

M is N or CR^7 , wherein R^7 has the same definition as R^4 defined above;

10

R^5 is $C(Y^1)Z$ wherein Y^1 is O or S;

Z is $N(R^{6a})R^6$ or OR^6 , wherein R^{6a} is H or (C_{1-6}) alkyl or $NR^{61}R^{62}$ wherein R^{61} and R^{62} are each independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, or both R^{61} and R^{62} are covalently bonded together and to the nitrogen to which they are both attached to form a 5, 6 or 7-membered saturated heterocycle; or R^{62} is $COOR^{63}$ wherein R^{63} is (C_{1-6}) alkyl, (C_{3-6}) cycloalkyl, said alkyl or cycloalkyl being optionally substituted with 6- or 10-membered aryl or Het; or R^{62} is COR^{64} wherein R^{64} is (C_{1-6}) alkyl, (C_{3-6}) cycloalkyl -6-or 10-membered aryl or Het; and

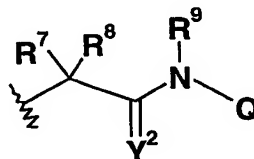
15

20

R^6 is selected from the group consisting of: H, (C_{1-6}) alkyl, (C_{3-6}) cycloalkyl, (C_{2-6}) alkenyl, 6- or 10-membered aryl, Het, (C_{1-6}) alkyl-aryl, (C_{1-6}) alkyl-Het, wherein said alkyl, cycloalkyl, alkenyl, aryl, Het, alkyl-aryl, or alkyl-Het, are all optionally substituted with R^{60} ;

25

or R^6 is



wherein R^7 and R^8 are each independently H, (C_{1-6}) alkyl, haloalkyl, (C_{3-7}) cycloalkyl, 6- or 10-membered aryl, Het, (C_{1-6}) alkyl-aryl, (C_{1-6}) alkyl-Het, wherein said alkyl, cycloalkyl, aryl, Het, (C_{1-6}) alkyl-aryl, (C_{1-6}) alkyl-Het are optionally substituted with R^{70} ;

30

or

R^7 and R^8 are covalently bonded together to form second (C_{3-7}) cycloalkyl or a 4, 5- or

6-membered heterocycle having from 1 to 4 heteroatom selected from O, N, and S;
or when Z is N(R^{6a})R⁶, either of R⁷ or R⁸ is covalently bonded to R^{6a} to form a
nitrogen-containing 5- or 6-membered heterocycle;

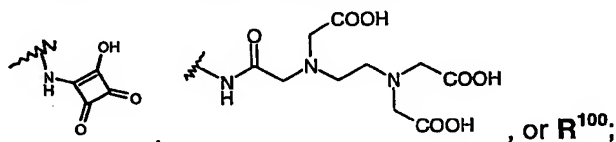
5 Y² is O or S;

R⁹ is H, (C₁₋₆ alkyl), (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl-
aryl or (C₁₋₆)alkyl-Het, all of which optionally substituted with R⁹⁰; or

R⁹ is covalently bonded to either of R⁷ or R⁸ to form a 5- or 6-membered heterocycle;

10

Q is a 6- or 10-membered aryl, Het, (C₁₋₆) alkyl-CONH-aryl or (C₁₋₆) alkyl-CONH-Het,
all of which being optionally substituted with:



or a salt or a derivative thereof;

15

wherein Het is defined as 5- or 6-membered heterocycle having 1 to 4 heteroatoms
selected from O, N, and S, or a 9- or 10-membered heterobicyclic having 1 to 4
heteroatoms selected from O, N and S; and

20 R¹⁰, R²⁰, R⁶⁰, R⁷⁰, R⁹⁰ and R¹⁰⁰ is each defined as:

- 1 to 4 substituents selected from: halogen, OPO₃H, NO₂, cyano, azido,
C(=NH)NH₂, C(=NH)NH(C₁₋₆)alkyl or C(=NH)NHCO(C₁₋₆)alkyl; or

- 1 to 4 substituents selected from:

25 a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally
containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)
cycloalkyl, all of which optionally substituted with R¹⁵⁰;

b) OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)
cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het, said alkyl, cycloalkyl,
aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het being optionally substituted with
30 R¹⁵⁰;

c) OCOR¹⁰⁵ wherein R¹⁰⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)
cycloalkyl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het, said alkyl, cycloalkyl, aryl,

- Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;
- d) SR¹⁰⁸, SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both R¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁵⁰;
- e) NR¹¹¹R¹¹² wherein R¹¹¹ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and R¹¹² is H, CN, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with R¹⁵⁰;
- f) NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;
- g) NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁵⁰;
- h) NR¹²¹COCOR¹²² wherein R¹²¹ and R¹²² is each is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰; or R¹²² is OR¹²³ or N(R¹²⁴)₂ wherein R¹²³ and each R¹²⁴ is independently H,

74

- (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or **R**¹²⁴ is OH or O(C₁₋₆alkyl) or both **R**¹²⁴ are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with **R**¹⁵⁰;
- 5 **i)** **COR**¹²⁷ wherein **R**¹²⁷ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰;
- 10 **j)** **COOR**¹²⁸ wherein **R**¹²⁸ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰;
- 15 **k)** **CONR**¹²⁹**R**¹³⁰ wherein **R**¹²⁹ and **R**¹³⁰ are independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both **R**¹²⁹ and **R**¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with **R**¹⁵⁰;
- 20 **l)** aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with **R**¹⁵⁰; and
- wherein **R**¹⁵⁰ is defined as:
- 1 to 3 substituents selected from: halogen, OPO₃H, NO₂, cyano, azido, C(=NH)NH₂, C(=NH)NH(C₁₋₆alkyl) or C(=NH)NHCO(C₁₋₆alkyl);
 - or
- 25 - 1 to 3 substituents selected from:
- a)** (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with **R**¹⁶⁰;
 - b)** **OR**¹⁰⁴ wherein **R**¹⁰⁴ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁶⁰;
 - c)** **OCOR**¹⁰⁵ wherein **R**¹⁰⁵ is (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl,
- 30

75.

aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁶⁰;

d) SR¹⁰⁸, SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both R¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁶⁰;

e) NR¹¹¹R¹¹² wherein R¹¹¹ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and R¹¹² is H, CN, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with R¹⁶⁰;

f) NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁶⁰;

g) NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted

with R^{160} ;

h) $NR^{121}COCOR^{122}$ wherein R^{121} and R^{122} is each is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, a 6- or 10-membered aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** being optionally substituted with R^{160} ;

or R^{122} is OR^{123} or $N(R^{124})_2$ wherein R^{123} and each R^{124} is independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, or R^{124} is OH or $O(C_{1-6})$ alkyl or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** and heterocycle being optionally substituted with R^{160} ;

i) COR^{127} wherein R^{127} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** being optionally substituted with R^{160} ;

j) tetrazole, $COOR^{128}$ wherein R^{128} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, said (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl and (C_{1-6}) alkyl)**Het** being optionally substituted with R^{160} ; and

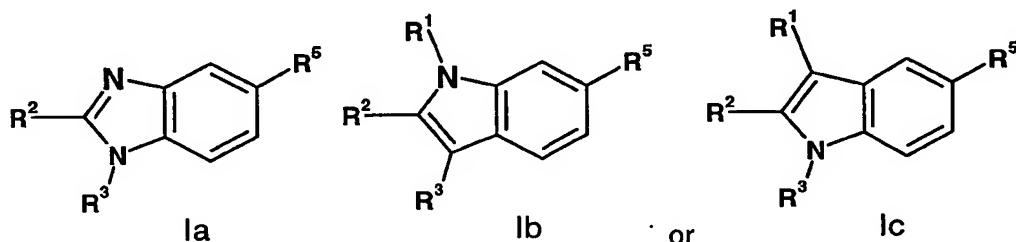
k) $CONR^{129}R^{130}$ wherein R^{129} and R^{130} are independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl, (C_{1-6}) alkyl)**Het** and heterocycle being optionally substituted with R^{160} ;

wherein R^{160} is defined as 1 or 2 substituents selected from: tetrazole, halogen, CN, C_{1-6} alkyl, haloalkyl, $COOR^{161}$, SO_3H , SR^{161} , SO_2R^{161} , OR^{161} , $N(R^{162})_2$, $SO_2N(R^{162})_2$, or $CON(R^{162})_2$, wherein R^{161} and each R^{162} is independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl; or both R^{162} are

covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

- wherein said probe comprises a detectable label attached to any suitable position,
 5 whereby said probe binds to an HCV polymerase or an analog thereof and is capable of being displaced by an inhibitor thereof;

3. The method according to claim 2, wherein said probe has the following formula:



wherein

- 10 **R¹** is selected from the group consisting of: H or (C₁₋₆)alkyl;

R² is CON(R²²)₂, wherein each **R²²** is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₅₋₇)cycloalkenyl, 6 or 10-membered aryl or **Het**, or both **R²²** are bonded together to form a 5, 6 or 7-membered saturated heterocycle with the nitrogen to which they are
 15 attached;

or **R²** is selected from: H, halogen, (C₁₋₆)alkyl, haloalkyl, (C₂₋₆)alkenyl, (C₅₋₇)cycloalkenyl, 6 or 10-membered aryl or **Het**; wherein each of said alkyl, haloalkyl, (C₂₋₆)alkenyl, (C₅₋₇)cycloalkenyl, aryl or **Het** is optionally substituted with **R²⁰**, wherein **R²⁰** is defined as:

- 20 - 1 to 4 substituents selected from: halogen, NO₂, cyano, azido, C(=NH)NH₂, C(=NH)NH(C₁₋₆)alkyl or C(=NH)NHCO(C₁₋₆)alkyl; or
 - 1 to 4 substituents selected from:
 a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with **R¹⁵⁰**;
 25 b) OR¹⁰⁴ wherein **R¹⁰⁴** is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** being optionally substituted with **R¹⁵⁰**;

- c) OCOR^{105} wherein R^{105} is $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$, said alkyl, cycloalkyl, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$ being optionally substituted with R^{150} ;
- d) SR^{108} , SO_3H , $\text{SO}_2\text{N}(\text{R}^{108})_2$ or $\text{SO}_2\text{N}(\text{R}^{108})\text{C}(\text{O})\text{R}^{108}$ wherein each R^{108} is independently H, $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$ or $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$ or both R^{108} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$ or heterocycle being optionally substituted with R^{150} ;
- e) $\text{NR}^{111}\text{R}^{112}$ wherein R^{111} is H, $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$ or $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$, and R^{112} is H, CN, $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$ or $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$, $(\text{C}_{1-6})\text{alkyl})\text{Het}$, COOR^{115} or $\text{SO}_2\text{R}^{115}$ wherein R^{115} is $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, or $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$, or both R^{111} and R^{112} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$, or heterocycle being optionally substituted with R^{150} ;
- f) $\text{NR}^{116}\text{COR}^{117}$ wherein R^{116} and R^{117} is each H, $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$, said $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$ being optionally substituted with R^{150} ;
- g) $\text{NR}^{118}\text{CONR}^{119}\text{R}^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$, or R^{118} is covalently bonded to R^{119} and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$ or heterocycle being optionally substituted with R^{150} ;
- h) $\text{NR}^{121}\text{COCOR}^{122}$ wherein R^{121} and R^{122} is each is H, $(\text{C}_{1-6})\text{alkyl}$, $(\text{C}_{3-7})\text{cycloalkyl}$, $(\text{C}_{1-6})\text{alkyl}-(\text{C}_{3-7})\text{cycloalkyl}$, a 6- or 10-membered aryl, **Het**, $(\text{C}_{1-6})\text{alkyl})\text{aryl}$ or $(\text{C}_{1-6})\text{alkyl})\text{Het}$, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**,

- (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;
 or R¹²² is OR¹²³ or N(R¹²⁴)₂ wherein R¹²³ and each R¹²⁴ is independently H,
 (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R¹²⁴ is OH or O(C₁₋₆alkyl) or both R¹²⁴ are
 5 covalently bonded together to form a 5, 6 or 7-membered saturated
 heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or
 (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;
- i) COR¹²⁷ wherein R¹²⁷ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl,
 10 aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;
- j) COOR¹²⁸ wherein R¹²⁸ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;
- 15 k) CONR¹²⁹R¹³⁰ wherein R¹²⁹ and R¹³⁰ are independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the
 nitrogen to which they are attached to form a 5, 6 or 7-membered saturated
 heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl,
 20 (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;
- l) aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally
 substituted with R¹⁵⁰;
- wherein R¹⁵⁰ is preferably:
- 1 to 3 substituents selected from: halogen, NO₂, cyano or azido; or
 - 1 to 3 substituents selected from:
- 25 a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, (C₂₋₆)alkenyl, (C₂₋₆)alkynyl,
 (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁶⁰;
- b) OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆alkyl) or (C₃₋₇)cycloalkyl, said alkyl or
 cycloalkyl optionally substituted with R¹⁶⁰;
- 30 d) SR¹⁰⁸, SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each
 R¹⁰⁸ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl or (C₁₋₆alkyl)-(C₃₋₇)cycloalkyl, aryl, **Het**, or both R¹⁰⁸ are covalently bonded together and
 to the nitrogen to which they are attached to form a 5, 6 or 7-
 membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het** and

heterocycle being optionally substituted with R^{160} ;

e) $NR^{111}R^{112}$ wherein R^{111} is H, (C_{1-6}) alkyl, or (C_{3-7}) cycloalkyl, and R^{112} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, $COOR^{115}$ or SO_2R^{115} wherein R^{115} is (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or both R^{111} and R^{112} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl and heterocycle being optionally substituted with R^{160} ;

f) $NR^{116}COR^{117}$ wherein R^{116} and R^{117} is each H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl said (C_{1-6}) alkyl and (C_{3-7}) cycloalkyl being optionally substituted with R^{160} ;

g) $NR^{118}CONR^{119}R^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or R^{118} is covalently bonded to R^{119} and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

said alkyl, cycloalkyl, and heterocycle being optionally substituted with R^{160} ;

h) $NR^{121}COCOR^{122}$ wherein R^{121} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said alkyl and cycloalkyl being optionally substituted with R^{160} ; or R^{122} is OR^{123} or $N(R^{124})_2$ wherein R^{123} and each R^{124} is independently H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl and heterocycle being optionally substituted with R^{160} ;

i) COR^{127} wherein R^{127} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said alkyl and cycloalkyl being optionally substituted with R^{160} ;

j) $COOR^{128}$ wherein R^{128} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said (C_{1-6}) alkyl and (C_{3-7}) cycloalkyl being optionally substituted with R^{160} ; and

k) $CONR^{129}R^{130}$ wherein R^{129} and R^{130} are independently H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6

or 7-membered saturated heterocycle, said alkyl, cycloalkyl and heterocycle being optionally substituted with R^{160} ;

wherein R^{160} is defined as 1 or 2 substituents selected from: halogen, CN, C_{1-6} alkyl, haloalkyl, $COOR^{161}$, OR^{161} , $N(R^{162})_2$, $SO_2N(R^{162})_2$, or $CON(R^{162})_2$, wherein R^{161} and each R^{162} is independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl; or both R^{162} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

R^3 is selected from (C_{3-7}) cycloalkyl, (C_{6-10}) bicycloalkyl, 6- or 10-membered aryl, or Het;

R^5 is $-C(O)-Z$, wherein

Z is OR^6 wherein R^6 is C_{1-6} alkyl substituted with:

- 1 to 4 substituents selected from: OPO_3H , NO_2 , cyano, azido, $C(=NH)NH_2$, $C(=NH)NH(C_{1-6})$ alkyl or $C(=NH)NHCO(C_{1-6})$ alkyl; or

- 1 to 4 substituents selected from:

a) (C_{1-6}) alkyl or haloalkyl, (C_{3-7}) cycloalkyl, C_{3-7} spirocycloalkyl optionally containing 1 or 2 heteroatom, (C_{2-6}) alkenyl, (C_{2-8}) alkynyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, all of which optionally substituted with R^{150} ;

b) OR^{104} wherein R^{104} is (C_{1-6}) alkyl substituted with R^{150} , (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het, said cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het being optionally substituted with R^{150} ;

c) $OCOR^{105}$ wherein R^{105} is (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het, said alkyl, cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het being optionally substituted with R^{150} ;

d) SR^{108} , SO_3H , $SO_2N(R^{108})_2$ or $SO_2N(R^{108})C(O)R^{108}$ wherein each R^{108} is independently H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het or both R^{108} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het being optionally substituted with R^{150} ;

₆alkyl)aryl or (C₁₋₆alkyl)Het or heterocycle being optionally substituted with R¹⁵⁰;

e) NR¹¹¹R¹¹² wherein R¹¹¹ is (C₁₋₆)alkyl substituted with R¹⁵⁰, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, and
 5 R¹¹² is CN, (C₁₋₆)alkyl substituted with R¹⁵⁰, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)Het, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6
 10 or 7-membered saturated heterocycle, said cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or heterocycle being optionally substituted with R¹⁵⁰;

f) NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or
 15 (C₁₋₆alkyl)Het being optionally substituted with R¹⁵⁰;

g) NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;
 20 or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het or heterocycle being optionally substituted with R¹⁵⁰;

h) NR¹²¹COCOR¹²² wherein R¹²¹ and R¹²² is each is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het being optionally substituted with R¹⁵⁰;
 25 or R¹²² is OR¹²³ or N(R¹²⁴)₂ wherein R¹²³ and each R¹²⁴ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or R¹²⁴ is OH or O(C₁₋₆alkyl) or both R¹²⁴ are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het and heterocycle being optionally substituted with R¹⁵⁰;

30 i) COR¹²⁷ wherein R¹²⁷ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or R¹²⁷ is covalently bonded to the oxygen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het being optionally substituted with R¹⁵⁰;

- ₇cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;
- j) COOR¹²⁸ wherein R¹²⁸ is (C₁₋₆)alkyl substituted with R¹⁵⁰, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;
- k) CONR¹²⁹R¹³⁰ wherein R¹²⁹ and R¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;
- l) aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with R¹⁵⁰; wherein R¹⁵⁰ is:
- 1 to 3 substituents selected from: halogen, NO₂, cyano, azido or
 - 1 to 3 substituents selected from:
 - a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁶⁰;
 - b) OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁶⁰;
 - d) SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both R¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R¹⁶⁰;
 - e) NR¹¹¹R¹¹² wherein R¹¹¹ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and R¹¹² is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R¹¹⁵

is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both **R**¹¹¹ and **R**¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with **R**¹⁶⁰;

f) NR¹¹⁶**COR**¹¹⁷ wherein **R**¹¹⁶ and **R**¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁶⁰;

g) NR¹¹⁸**CONR**¹¹⁹**R**¹²⁰, wherein **R**¹¹⁸, **R**¹¹⁹ and **R**¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or **R**¹¹⁹ and **R**¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with **R**¹⁶⁰;

h) NR¹²¹**COCOR**¹²² wherein **R**¹²¹ is H, (C₁₋₆)alkyl optionally substituted with **R**¹⁶⁰;

or **R**¹²² is **OR**¹²³ or **N(R**¹²⁴**)**₂ wherein **R**¹²³ and each **R**¹²⁴ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or **R**¹²⁴ is OH or O(C₁₋₆alkyl) or both **R**¹²⁴ are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with **R**¹⁶⁰;

j) tetrazole, COOR¹²⁸ wherein **R**¹²⁸ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁶⁰, and

k) CONR¹²⁹**R**¹³⁰ wherein **R**¹²⁹ and **R**¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋

alkyl)aryl or (C₁₋₆alkyl)Het, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)Het and heterocycle being optionally substituted with R¹⁶⁰;

wherein R¹⁶⁰ is defined as 1 or 2 substituents selected from: tetrazole, halogen, CN, C₁₋₆alkyl, haloalkyl, COOR¹⁶¹, SO₃H, SO₂R¹⁶¹, OR¹⁶¹, N(R¹⁶²)₂, SO₂N(R¹⁶²)₂, or CON(R¹⁶²)₂, wherein R¹⁶¹ and each R¹⁶² is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl; or both R¹⁶² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

or Z is N(R^{6a})R⁶, wherein R^{6a} is H or (C₁₋₆alkyl) and

R⁶ is (C₁₋₆)alkyl optionally substituted with:

- 1 to 4 substituents selected from: OPO₃H, NO₂, cyano, azido, C(=NH)NH₂, C(=NH)NH(C₁₋₆)alkyl or C(=NH)NHCO(C₁₋₆)alkyl; or

- 1 to 4 substituents selected from:

a) (C₁₋₆) alkyl substituted with R^{150a}, haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₆)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁵⁰, wherein R^{150a} is the same as R¹⁵⁰ but is not halogen, OR^{150b}, COOR^{150b}, N(R^{150b})₂, wherein R^{150b} is H or C₁₋₆alkyl;

b) OR¹⁰⁴ wherein R¹⁰⁴ is (C₁₋₆alkyl) substituted with R¹⁵⁰, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het being optionally substituted with R¹⁵⁰;

c) OCOR¹⁰⁵ wherein R¹⁰⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said alkyl, cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het being optionally substituted with R¹⁵⁰;

d) SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl,

- Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both **R**¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with **R**¹⁵⁰;
- 5 **e) NR**¹¹¹**R**¹¹² wherein **R**¹¹¹ is (C₁₋₆)alkyl substituted with **R**¹⁵⁰, (C₃₋₇)cycloalkyl or (C₁₋₈)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and **R**¹¹² is H, CN, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** or
- 10 **R**¹¹¹ is H and **R**¹¹² is SO₂**R**¹¹⁵ wherein **R**¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both **R**¹¹¹ and **R**¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being
- 15 optionally substituted with **R**¹⁵⁰;
- f) NR**¹¹⁶**COR**¹¹⁷ wherein **R**¹¹⁶ and **R**¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰;
- 20 **g) NR**¹¹⁸**CONR**¹¹⁹**R**¹²⁰, wherein **R**¹¹⁸, **R**¹¹⁹ and **R**¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or **R**¹¹⁸ is covalently bonded to **R**¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;
- 25 or **R**¹¹⁹ and **R**¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with **R**¹⁵⁰;
- h) NR**¹²¹**COCOR**¹²² wherein **R**¹²¹ and **R**¹²² is each is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰;
- 30 or **R**¹²² is OR¹²³ or N(**R**¹²⁴)₂ wherein **R**¹²³ and each **R**¹²⁴ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or **R**¹²⁴ is OH or O(C₁₋₆alkyl) or both **R**¹²⁴ are

covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;

5 **i)** COR¹²⁷ wherein R¹²⁷ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

j) COOR¹²⁸ wherein R¹²⁸ is (C₁₋₆)alkyl substituted with R¹⁵⁰, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁵⁰;

10 **k)** CONR¹²⁹R¹³⁰ wherein R¹²⁹ and R¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁵⁰;

15 **l)** aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with R¹⁵⁰; and

wherein R¹⁵⁰ is selected from:

20 - 1 to 3 substituents selected from: halogen, NO₂, cyano, azido or
- 1 to 3 substituents selected from:

a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁶⁰;

25 **b)** OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁶⁰;

30 **d)** SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or both R¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or

heterocycle being optionally substituted with R^{160} ;

e) $NR^{111}R^{112}$ wherein R^{111} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, and R^{112} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het**, $COOR^{115}$ or SO_2R^{115} wherein R^{115} is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R^{111} and R^{112} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or heterocycle being optionally substituted with R^{160} ;

f) $NR^{116}COR^{117}$ wherein R^{116} and R^{117} is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R^{160} ;

g) $NR^{118}CONR^{119}R^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R^{160} ;

h) $NR^{121}COCOR^{122}$ wherein R^{121} is H, (C₁₋₆)alkyl optionally substituted with R^{160} ;

or R^{122} is OR^{123} or $N(R^{124})_2$ wherein R^{123} and each R^{124} is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R^{124} is OH or O(C₁₋₆alkyl) or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R^{160} ;

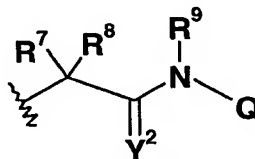
j) tetrazole, $COOR^{128}$ wherein R^{128} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**,

said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R¹⁶⁰; and

k) CONR¹²⁹R¹³⁰ wherein R¹²⁹ and R¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R¹⁶⁰;

wherein R¹⁶⁰ is defined as 1 or 2 substituents selected from: tetrazole, halogen, CN, C₁₋₆alkyl, haloalkyl, COOR¹⁶¹, SO₃H, SO₂R¹⁶¹, OR¹⁶¹, N(R¹⁶²)₂, SO₂N(R¹⁶²)₂, or CON(R¹⁶²)₂, wherein R¹⁶¹ and each R¹⁶² is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl; or both R¹⁶² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

or R⁶ is



wherein, preferably, R⁷ and R⁸ are each independently H, (C₁₋₆)alkyl, haloalkyl, (C₃₋₇)cycloalkyl, 6- or 10-membered aryl, **Het**, (C₁₋₆)alkyl-aryl, (C₁₋₆)alkyl-**Het**, wherein said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl-aryl, (C₁₋₆)alkyl-**Het** are optionally substituted with R⁷⁰; or

R⁷ and R⁸ are covalently bonded together to form second (C₃₋₇)cycloalkyl or a 4, 5- or 6-membered heterocycle having from 1 to 3 heteroatom selected from O, N, and S; or when Z is N(R^{6a})R⁶, either of R⁷ or R⁸ is covalently bonded to R^{6a} to form a nitrogen-containing 5- or 6-membered heterocycle;

wherein R⁷⁰ is selected from:

- 1 to 4 substituents selected from: halogen, NO₂, cyano, azido; or

- 1 to 4 substituents selected from:

- a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁵⁰;
- 5 b) OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het, said alkyl, cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het being optionally substituted with R¹⁵⁰;
- 10 d) SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het or both R¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het or heterocycle being optionally substituted with R¹⁵⁰;
- 15 e) NR¹¹¹R¹¹² wherein R¹¹¹ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het, and R¹¹² is H, CN, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl, (C₁₋₆)alkyl)Het, COOR¹¹⁵ or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het, or heterocycle being optionally substituted with R¹⁵⁰;
- 20 f) NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het being optionally substituted with R¹⁵⁰;
- 25 g) NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)Het, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆)alkyl)aryl or (C₁₋
- 30

alkyl)Het or heterocycle being optionally substituted with R^{150} ;

h) $NR^{121}COCOR^{122}$ wherein R^{121} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het being optionally substituted with R^{150} ;

and R^{122} is OR^{123} or $N(R^{124})_2$ wherein R^{123} and each R^{124} is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or R^{124} is OH or O(C₁₋₆alkyl) or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het and heterocycle being optionally substituted with R^{150} ;

i) COR^{127} wherein R^{127} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said alkyl, cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het being optionally substituted with R^{150} ;

j) $COOR^{128}$ wherein R^{128} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)Het being optionally substituted with R^{150} ;

k) $CONR^{129}R^{130}$ wherein R^{129} and R^{130} are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)Het and heterocycle being optionally substituted with R^{150} ;

l) aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, all of which being optionally substituted with R^{150} ;

wherein R^{150} is selected from:

- 1 to 3 substituents selected from: halogen, NO₂, cyano, azido; or
- 1 to 3 substituents selected from:

a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₆)alkynyl, all of which optionally substituted with R^{160} ;

b) OR^{104} wherein R^{104} is H, (C₁₋₆alkyl) or (C₃₋₇)cycloalkyl, said alkyl and cycloalkyl being optionally substituted with R^{160} ;

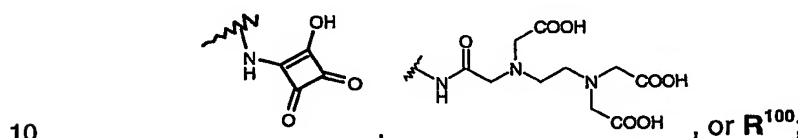
- d) $\text{SO}_2\text{N}(\text{R}^{108})_2$ wherein R^{108} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said alkyl or cycloalkyl being optionally substituted with R^{160} ;
- e) $\text{NR}^{111}\text{R}^{112}$ wherein R^{111} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, and R^{112} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl, (C_{1-6}) alkyl)Het, COOR^{115} or $\text{SO}_2\text{R}^{115}$ wherein R^{115} is (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het, or both R^{111} and R^{112} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, Het, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)Het, or heterocycle being optionally substituted with R^{160} ;
- f) $\text{NR}^{116}\text{COR}^{117}$ wherein R^{116} and R^{117} is each H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl being optionally substituted with R^{160} ;
- g) $\text{NR}^{118}\text{CONR}^{119}\text{R}^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl; or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl or heterocycle being optionally substituted with R^{160} ;
- h) $\text{NR}^{121}\text{COCOR}^{122}$ wherein R^{121} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said alkyl or cycloalkyl being optionally substituted with R^{160} ; or R^{122} is OR^{123} or $\text{N}(\text{R}^{124})_2$ wherein R^{123} and each R^{124} is independently H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or R^{124} is OH or $\text{O}(\text{C}_{1-6})$ alkyl or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl and heterocycle being optionally substituted with R^{160} ;
- i) tetrazole, COOR^{128} wherein R^{128} is H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, said (C_{1-6}) alkyl and (C_{3-7}) cycloalkyl being optionally substituted with R^{160} ; and
- k) $\text{CONR}^{129}\text{R}^{130}$ wherein R^{129} and R^{130} are independently H, (C_{1-6}) alkyl or (C_{3-7}) cycloalkyl, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl and heterocycle being optionally substituted with R^{160} ;

wherein R^{160} is defined as 1 or 2 substituents selected from: tetrazole, halogen, CN, C_{1-6} alkyl, haloalkyl, $COOR^{161}$, OR^{161} , $N(R^{162})_2$ or $CON(R^{162})_2$, wherein R^{161} and each R^{162} is independently H or (C_{1-6}) alkyl;

5

R^9 is H; or R^9 is covalently bonded to either of R^7 or R^8 to form a 5- or 6-membered heterocycle; and

Q is a 6- or 10-membered aryl, **Het**, all of which being optionally substituted with:



wherein R^{100} is:

- 1 to 4 substituents selected from: halogen, NO_2 , cyano or azido; or
- 1 to 4 substituents selected from:

- 15
- a) (C_{1-6}) alkyl or haloalkyl, (C_{3-7}) cycloalkyl, (C_{2-6}) alkenyl, (C_{2-8}) alkynyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, all of which optionally substituted with R^{150} ;
 - b) OR^{104} wherein R^{104} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** being optionally substituted with R^{150} ;

20

 - e) $NR^{111}R^{112}$ wherein R^{111} is H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, and R^{112} is H, CN, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl, (C_{1-6}) alkyl)**Het**, $COOR^{115}$ or SO_2R^{115} wherein R^{115} is (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, or (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, or both R^{111} and R^{112} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, or heterocycle being optionally substituted with R^{150} ;

25

 - f) $NR^{116}COR^{117}$ wherein R^{116} and R^{117} is each H, (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het**, said (C_{1-6}) alkyl, (C_{3-7}) cycloalkyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, aryl, **Het**, (C_{1-6}) alkyl)aryl or (C_{1-6}) alkyl)**Het** being optionally substituted with R^{150} ;

30

- g) $\text{NR}^{118}\text{CONR}^{119}\text{R}^{120}$, wherein R^{118} , R^{119} and R^{120} is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R^{118} is covalently bonded to R^{119} and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;
 5 or R^{119} and R^{120} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;
 said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** or heterocycle being optionally substituted with R^{150} ;
- h) $\text{NR}^{121}\text{COCOR}^{122}$ wherein R^{121} and R^{122} is each is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with R^{150} ;
 10 or R^{122} is OR^{123} or $\text{N}(\text{R}^{124})_2$ wherein R^{123} and each R^{124} is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or R^{124} is OH or O(C₁₋₆alkyl) or both R^{124} are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R^{150} ;
- j) COOR^{128} wherein R^{128} is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with R^{150} ;
- k) $\text{CONR}^{129}\text{R}^{130}$ wherein R^{129} and R^{130} are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both R^{129} and R^{130} are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with R^{150} ;
- l) aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with R^{150} ;
- 30

wherein R^{150} is selected from:

- 1 to 3 substituents selected from: halogen, NO₂, cyano or azido; or
- 1 to 3 substituents selected from:

a) (C₁₋₆) alkyl or haloalkyl, (C₃₋₇)cycloalkyl, C₃₋₇ spirocycloalkyl

optionally containing 1 or 2 heteroatom, (C₂₋₆)alkenyl, (C₂₋₈)alkynyl, (C₁₋₆) alkyl-(C₃₋₇)cycloalkyl, all of which optionally substituted with R¹⁶⁰;

b) OR¹⁰⁴ wherein R¹⁰⁴ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** being optionally substituted with R¹⁶⁰;

d) SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** or both R¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** or heterocycle being optionally substituted with R¹⁶⁰;

e) NR¹¹¹R¹¹² wherein R¹¹¹ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, and R¹¹² is H, CN, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl, (C₁₋₆)alkyl)**Het** or SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, or heterocycle being optionally substituted with R¹⁶⁰;

f) NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** being optionally substituted with R¹⁶⁰;

g) NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to

which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het or heterocycle being optionally substituted with R¹⁶⁰;

h) NR¹²¹COCOR¹²² wherein R¹²¹ is H, (C₁₋₆)alkyl optionally substituted with R¹⁶⁰;

or R¹²² is OR¹²³ or N(R¹²⁴)₂ wherein R¹²³ and each R¹²⁴ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or R¹²⁴ is OH or O(C₁₋₆alkyl) or both R¹²⁴ are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het and heterocycle being optionally substituted with R¹⁶⁰;

j) tetrazole, COOR¹²⁸ wherein R¹²⁸ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)Het being optionally substituted with R¹⁶⁰; and

k) CONR¹²⁹R¹³⁰ wherein R¹²⁹ and R¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)Het, or both R¹²⁹ and R¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, Het, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)Het and heterocycle being optionally substituted with R¹⁶⁰;

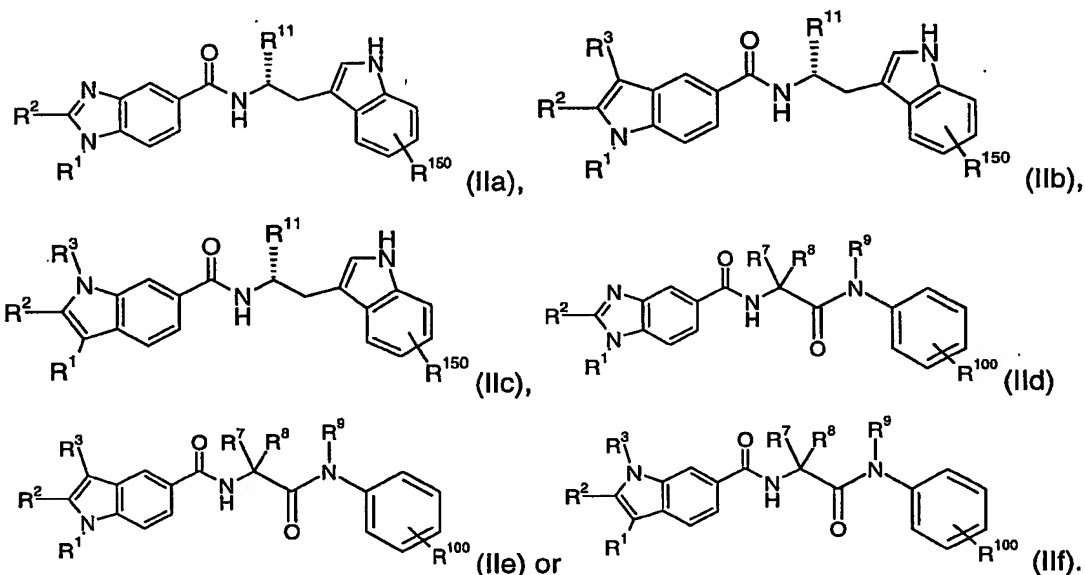
wherein R¹⁶⁰ is defined as 1 or 2 substituents selected from: tetrazole, halogen, CN, C₁₋₆alkyl, haloalkyl, COOR¹⁶¹, SO₃H, SR¹⁶¹, SO₂R¹⁶¹, OR¹⁶¹, N(R¹⁶²)₂, SO₂N(R¹⁶²)₂, or CON(R¹⁶²)₂, wherein R¹⁶¹ and each R¹⁶² is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl; or both R¹⁶² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle;

or a salt thereof;

wherein said probe comprises a detectable label attached to any suitable position,
whereby said probe binds to an HCV polymerase or an analog thereof and is

5 capable of being displaced by an inhibitor thereof.

4. The method according to claim 3, wherein said probe is a compound having the following formula:



10 wherein R^1 is (C_{5-6}) cycloalkyl;

R^2 is phenyl, or Het both being optionally substituted with R^{20} ;

R^3 , R^7 , R^8 , R^9 , R^{100} , and R^{150} are as defined according to claim 2;

15

R^{11} is OPO_3H , NO_2 , cyano, azido, $C(=NH)NH_2$, $C(=NH)NH(C_{1-6})$ alkyl or $C(=NH)NHCO(C_{1-6})$ alkyl; or

20

- a) (C_{1-6}) alkyl substituted with R^{150a} , haloalkyl, (C_{3-7}) cycloalkyl, C_{3-7} spirocycloalkyl optionally containing 1 or 2 heteroatom, (C_{2-6}) alkenyl, (C_{2-8}) alkynyl, (C_{1-6}) alkyl- (C_{3-7}) cycloalkyl, all of which optionally substituted with R^{150} , wherein R^{150a} is the same as R^{150} but is not halogen, OR^{150b} , $COOR^{150b}$, $N(R^{150b})_2$, wherein R^{150b} is H or C_{1-6} alkyl;
- b) OR^{104} wherein R^{104} is (C_{1-6}) alkyl substituted with R^{150} , (C_{3-7}) cycloalkyl, or

(C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, said cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** being optionally substituted with R¹⁵⁰;

5 c) OCOR¹⁰⁵ wherein R¹⁰⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** being optionally substituted with R¹⁵⁰;

d) SO₃H, SO₂N(R¹⁰⁸)₂ or SO₂N(R¹⁰⁸)C(O)R¹⁰⁸ wherein each R¹⁰⁸ is independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** or both R¹⁰⁸ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** or heterocycle being optionally substituted with R¹⁵⁰;

15 e) NR¹¹¹R¹¹² wherein R¹¹¹ is (C₁₋₆)alkyl substituted with R¹⁵⁰, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, and R¹¹² is H, CN, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl, (C₁₋₆)alkyl)**Het** or

R¹¹¹ is H and R¹¹² is SO₂R¹¹⁵ wherein R¹¹⁵ is (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, or both R¹¹¹ and R¹¹² are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, or heterocycle being optionally substituted with R¹⁵⁰;

25 f) NR¹¹⁶COR¹¹⁷ wherein R¹¹⁶ and R¹¹⁷ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, said (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het** being optionally substituted with R¹⁵⁰;

g) NR¹¹⁸CONR¹¹⁹R¹²⁰, wherein R¹¹⁸, R¹¹⁹ and R¹²⁰ is each H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋₆)alkyl)**Het**, or R¹¹⁸ is covalently bonded to R¹¹⁹ and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; or R¹¹⁹ and R¹²⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle; said alkyl, cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆)alkyl)aryl or (C₁₋

₆alkyl)**Het** or heterocycle being optionally substituted with **R**¹⁵⁰;

h) **NR**¹²¹**COCOR**¹²² wherein **R**¹²¹ and **R**¹²² is each is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, a 6- or 10-membered aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰;

or **R**¹²² is **OR**¹²³ or **N(R**¹²⁴)₂ wherein **R**¹²³ and each **R**¹²⁴ is independently H, (C₁₋₆alkyl), (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or **R**¹²⁴ is OH or O(C₁₋₆alkyl) or both **R**¹²⁴ are covalently bonded together to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with **R**¹⁵⁰;

i) **COR**¹²⁷ wherein **R**¹²⁷ is H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said alkyl, cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰;

j) **COOR**¹²⁸ wherein **R**¹²⁸ is H or (C₁₋₆)alkyl substituted with **R**¹⁵⁰, (C₃₋₇)cycloalkyl; or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, said (C₃₋₇)cycloalkyl, or (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl and (C₁₋₆alkyl)**Het** being optionally substituted with **R**¹⁵⁰;

k) **CONR**¹²⁹**R**¹³⁰ wherein **R**¹²⁹ and **R**¹³⁰ are independently H, (C₁₋₆)alkyl, (C₃₋₇)cycloalkyl, (C₁₋₆)alkyl-(C₃₋₇)cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, or both **R**¹²⁹ and **R**¹³⁰ are covalently bonded together and to the nitrogen to which they are attached to form a 5, 6 or 7-membered saturated heterocycle, said alkyl, cycloalkyl, alkyl-cycloalkyl, aryl, **Het**, (C₁₋₆alkyl)aryl, (C₁₋₆alkyl)**Het** and heterocycle being optionally substituted with **R**¹⁵⁰;

l) aryl, **Het**, (C₁₋₆alkyl)aryl or (C₁₋₆alkyl)**Het**, all of which being optionally substituted with **R**¹⁵⁰

wherein **R**¹⁵⁰ is as defined in claim 3;

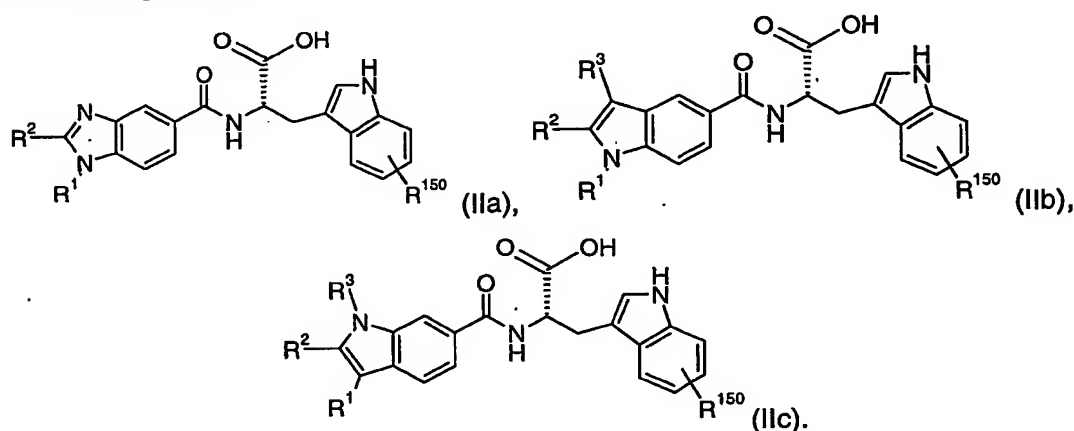
or a salt thereof;

wherein said compound is optionally:

- a) marked with a radioactive isotope at any suitable position,
- b) linked to a detectable moiety by a suitable linker suitable position, except **R**¹ and **R**³; or
- c) linked to an affinity tag at any suitable position, except **R**¹ and **R**³.

100

5. The method according to claim 4, wherein said probe is a compound having the following formula:



wherein R¹ is (C₅₋₆)cycloalkyl;

R² is phenyl, or Het both being optionally substituted with R²⁰;

5 R³ and R¹⁵⁰ are as defined in claim 4;

or a salt thereof;

wherein said compound is optionally:

- a) marked with a radioactive isotope at any suitable position;
- b) linked to a detectable moiety by a suitable linker at any suitable position,
- 10 except R¹ and R³; or
- c) linked to an affinity tag at any suitable position, except R¹ and R³.

6. The method according to claim 2 wherein the detectable label selected from the group consisting of: a fluorescent label a radioactive atom, a chemiluminescent label, and a colorimetric label.

7. The method according to claim 6 wherein the label is a fluorescent label or chemiluminescent label.

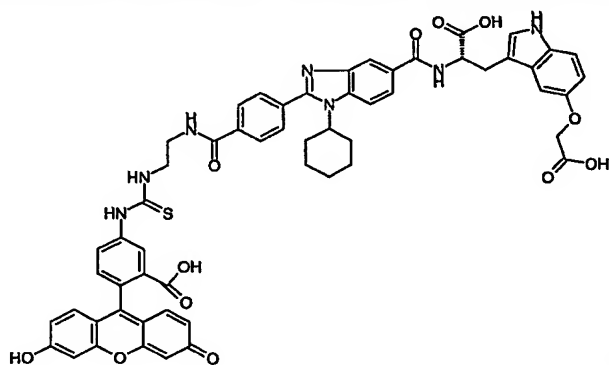
8. The method according to claim 7, wherein the fluorescent label is selected from the group consisting of: fluorescein, Oregon green, dansyl, rhodamine, Texas-red, phycoerythrin and Eu³⁺.

15

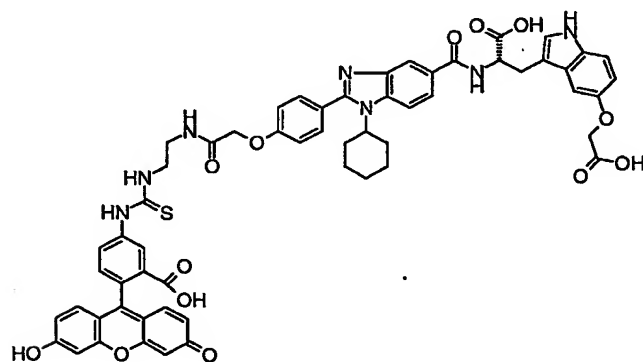
9. The method according to claim 8, wherein the fluorescent label is fluorescein.

101

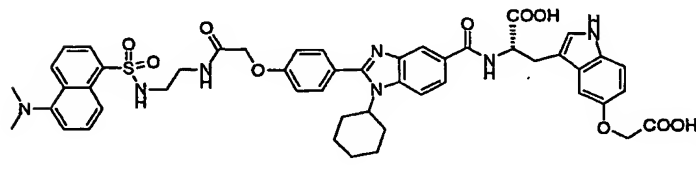
10. The method according to claim 2, wherein the detectable label is a fluorescent reporter/quencher pair.
11. The method according to claim 10, wherein the reporter/quencher pair is selected from the group consisting of: EDANS/DABCYL, tryptophan/2,4-dinitrophenyl, tryptophan/DANSYL, 7-methoxycoumarin/2,4-dinitrophenyl, 2-aminobenzoyl/2,4-dinitrophenyl and 2-aminobenzoyl/3-nitrotyrosine.
12. The method according to claim 6, wherein the radioactive atom is selected from ^3H , ^{14}C and ^{125}I .
13. The method according to claim 2, wherein the probe is selected from::



(i);

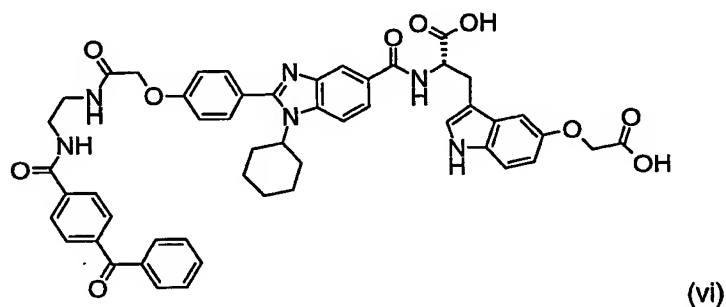
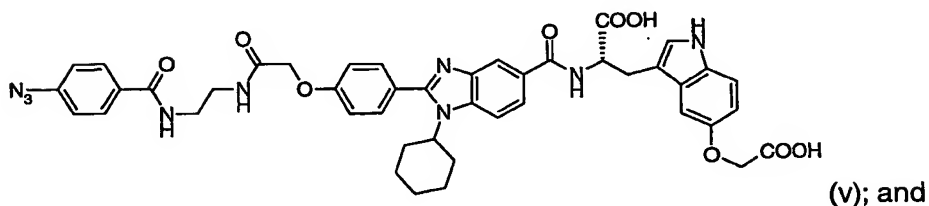
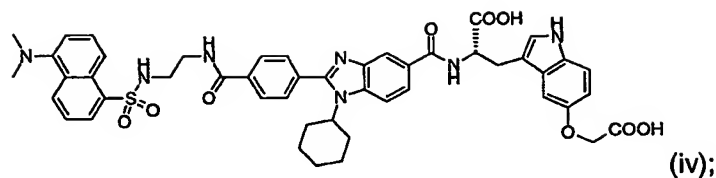


(ii);



(iii);

102



5

14. Use of a probe of formula I, according to claim 2, in the development of an assay for identifying inhibitors of HCV polymerase.
15. A method for identifying compounds that inhibit HCV polymerase comprising the steps of:
- a) contacting said HCV polymerase or an analog thereof with a probe of formula I, according to claim 2, so as to form a complex having said probe bound to said polymerase;
 - b) measuring the signal from said complex to establish a base line level;
 - c) incubating the product of step a) with a test compound; and
 - d) measuring the signal from said complex; and
 - e) comparing the signal from step d) with the signal from step b);
- whereby a modulation in said signal is an indication that said test compound inhibits said polymerase.
16. A method for identifying compounds capable of inhibiting HCV polymerase,

103

comprising:

f) repeating steps (a) to (e), according to claim 15, in a high throughput screen.

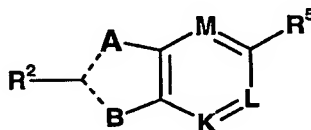
17. The method according to claim 15, wherein the HCV polymerase is selected from the group consisting of: NS5B; NS5BΔ21; and NS5BΔ57 or analogs thereof.

18. The method according to claim 15, wherein the HCV polymerase is obtained from genotype HCV-1a or HCV-1b strains optionally having a histidine tag at either the N- or C-terminal.

5

19. A kit for testing compounds potentially binding to HCV polymerase, said kit comprising the probe of formula (I) according to claim 2, and instructions on how to use said probe for identifying test compounds binding to said polymerase.

20. A probe of formula I:



I

A is O, S, NR³, or CR³;

B is NR¹ or CR¹; with the proviso that, when A is CR³, B is NR¹, and when A is O or S, B is CR¹;

10

----- represents either a single or a double bond;

R¹ is selected from the group consisting of: (C₄₋₇)cycloalkyl optionally substituted with (C₁₋₆ alkyl); norbornane, 5-, 6- or 7-membered heterocycle having 1 to 4 heteroatoms selected from O, N, and S, all of which optionally substituted with 1 to 4 substituent

15 selected from the group consisting of:

halo, OH and C₁₋₆ alkyl optionally substituted with hydroxy;

R² is selected from the group consisting of: phenyl, pyridine-N-oxide, 5- or 6-membered aromatic heterocycle having 1 to 4 heteroatoms selected from O, N, and S, and 9- or 10-membered aromatic heterobicyclic having 1 to 4 heteroatoms

20 selected from O, N and S;

said phenyl, pyridine-N-oxide, aromatic heterocycle and aromatic heterobicycle being optionally substituted with from 1 to 4 substituents selected from the group consisting of: halogen, C₁₋₆ haloalkyl, (C₁₋₆)alkyl, C₁₋₆ alkoxy, OH, amino optionally mono- or di-substituted with C₁₋₆ alkyl;

- 5 **R³** is selected from the group consisting of: H, (C₁₋₆)alkyl, (C₁₋₆ alkyl)-(C₆₋₁₀aryl), (C₁₋₆ alkyl)-5- or 6-membered heterocycle having 1 to 4 heteroatoms selected from O, N, and S, and 5- or 6-membered heterocycle having 1 to 4 heteroatoms selected from O, N and S,

wherein said aryl and said heterocycle are optionally substituted with from 1
10 to 4 substituents selected from the group consisting of: COOH, COO(C₁₋₆ alkyl), halogen, and (C₁₋₆ alkyl);

M is N, CR^{4a}, or COR^{4b}, wherein **R^{4a}** is selected from the group consisting of: H, halogen, and (C₁₋₆ alkyl); and **R^{4b}** is selected from the group consisting of: H and (C₁₋₆ alkyl);

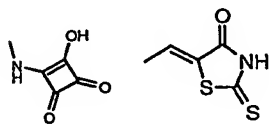
- 15 **K** and **L** is each independently N or CR⁶, wherein **R⁶** is H, halo, C₁₋₆ alkyl, OH, or C₁₋₆ alkoxy;

R⁵ is -C(Y)-Z, wherein **Y** is O or S; and **Z** is NHR^{5a} or OR^{5a},
wherein:

- R^{5a}** is selected from the group consisting of: H, (C₁₋₆)alkyl, (C₂₋₆)alkenyl,
20 (C₃₋₆)cycloalkyl optionally substituted with C₁₋₆alkyl or C₂₋₆alkenyl, (C₆₋₁₀)aryl optionally substituted with C₁₋₆alkyl or C₂₋₆alkenyl, N{(C₁₋₆) alkyl}₂, NHCOO(C₁₋₆)alkyl(C₆₋₁₀)aryl, NHCO(C₆₋₁₀)aryl, -5- or 6-atom heterocycle, having 1 to 4 heteroatoms selected from O, N and S, and -9- or 10-atom heterobicycle having 1 to 4 heteroatoms selected from O, N and S;

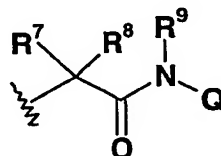
- 25 wherein said alkyl, alkenyl, cycloalkyl, aryl, heterocycle or heterobicycle are all optionally substituted with from 1 to 4 substituents selected from: OH, COOH, (C₁₋₆)alkyl, (C₂₋₄)alkenyl, (C₁₋₆)alkyl-hydroxy, COO(C₁₋₆)alkyl, C₃₋₇ cycloalkyl, benzyloxy, halogen, (C₂₋₄)alkenyl-(C₁₋₆)alkyl-COOH, coumarin, (C₁₋₆)alkyl-amino,
30 NH(C₁₋₆ alkyl), C(halogen)₃, -C(O)NH(C₁₋₄)alkyl, and -C(O)NH(C₆₋₁₀)aryl, 5- or 6-membered heterocycle having 1 to 4 heteroatoms selected from O, N and S, 9- or 10-membered heterobicycle having 1 to 4 heteroatoms selected from O, N and S, and 6- or 10-membered aryl;

wherein said alkyl, alkenyl, cycloalkyl, aryl, heterocycle and heterobicycle are all optionally substituted with from 1 to 4 substituents selected from: halogen, OPO_3H , sulfonamido, SO_3H , SO_2CH_3 , $-\text{CONH}_2$, $-\text{COCH}_3$, $(\text{C}_{1-3})\text{alkyl}$, $(\text{C}_{2-4}\text{alkenyl})\text{COOH}$, tetrazolyl, COOH , $-\text{CONH}_2$, triazolyl, OH , NO_2 , NH_2 , $-\text{O}(\text{C}_{1-6}\text{alkyl})\text{COOH}$, hydantoin, benzoyleneurea, $(\text{C}_{1-4})\text{alkoxy}$, cyano, azido, $-\text{O}(\text{C}_{1-6})\text{alkyl COOH}$, $-\text{O}(\text{C}_{1-6})\text{alkyl COO}(\text{C}_{1-6})\text{alkyl}$, $\text{NHCO}(\text{C}_{1-6}\text{alkyl})$, $-\text{NHCOCOOH}$, $-\text{NHCOCONHOH}$, $-\text{NHCOCONH}_2$, $-\text{NHCOCONHCH}_3$, $-\text{NHCO}(\text{C}_{1-6})\text{alkyl-COOH}$, $-\text{NHCOCONH}(\text{C}_{1-6})\text{alkyl-COOH}$, $-\text{NHCO}(\text{C}_{3-7})\text{cycloalkyl-COOH}$, $-\text{NHCONH}(\text{C}_{6-10})\text{aryl-COOH}$, $-\text{NHCONH}(\text{C}_{6-10})\text{aryl-COO}(\text{C}_{1-6})\text{alkyl}$, $-\text{NHCONH}(\text{C}_{1-6})\text{alkyl-COOH}$, $-\text{NHCONH}(\text{C}_{1-6})\text{alkyl-COO}(\text{C}_{1-6})\text{alkyl}$, $-\text{NHCONH}(\text{C}_{1-6})\text{alkyl}(\text{C}_{2-6})\text{alkenyl-COOH}$, $-\text{NH}(\text{C}_{1-6})\text{alkyl}(\text{C}_{6-10})\text{aryl-O}(\text{C}_{1-6})\text{alkyl COOH}$, $-\text{NH}(\text{C}_{1-6})\text{alkyl}(\text{C}_{6-10})\text{aryl-COOH}$, $-\text{NHCH}_2\text{COOH}$, $-\text{NHCONH}_2$, $-\text{NHCO}(\text{C}_{1-6})\text{hydroxyalkyl COOH}$, $-\text{OCO}(\text{C}_{1-6})\text{hydroxyalkyl COOH}$, $(\text{C}_{3-6})\text{cycloalkyl COOH}$,



, $-\text{NHCN}$, $-\text{NHCHO}$, $-\text{NHSO}_2\text{CH}_3$, $-\text{NHSO}_2\text{CF}_3$; and $-\text{O}(\text{C}_{1-6}\text{alkyl})\text{-tetrazol}$;

or R^{5a} is



wherein R^7 and R^8 are each independently H, $(\text{C}_{1-6}\text{alkyl})$, $(\text{C}_{3-7}\text{cycloalkyl})$, $(\text{C}_{1-6}\text{alkyl})\text{phenyl}$, $(\text{C}_{1-6}\text{alkyl})\text{-(C}_{3-7}\text{cycloalkyl)}$, $(\text{C}_{3-7}\text{cycloalkyl})\text{-(C}_{1-6}\text{alkyl)}$, $(\text{C}_{3-7}\text{cycloalkyl})\text{-(C}_{2-4}\text{alkenyl)}$, $(\text{C}_{1-6}\text{alkyl})\text{-OH}$, phenyl, $\text{CH}_2\text{biphenyl}$, 5- or 6-membered heterocycle having from 1 to 4 heteroatoms selected from O, N, and S, 9- or 10-membered heterobicycle having 1 to 4 heteroatoms selected from O, N, and S, $(\text{C}_{1-6}\text{alkyl})\text{-5- or 6-membered heterocycle having from 1 to 4 heteroatoms selected from O, N, and S}$, or $(\text{C}_{1-6}\text{alkyl})\text{-9- or 10-membered heterobicycle having 1 to 4 heteroatoms selected from O, N, and S}$, or R^7 and R^8 are covalently bonded together to form $(\text{C}_{3-7}\text{cycloalkyl})$, 4-, 5- or

6-membered heterocycle having from 1 to 4 heteroatoms selected from O, N, and S; or one of R^7 or R^8 is covalently bonded to R^9 to form a pyrrolidine;

wherein said alkyl, cycloalkyl, heterocycle, heterobicycle, phenyl are optionally substituted with from 1 to 4 substituents selected from the group consisting of: OH, COOH, (C₁₋₆ alkyl), (C₂₋₄ alkenyl), CONH₂, NH₂, NH(C₁₋₆ alkyl), N(C₁₋₆ alkyl)₂, NHCOCOOH, NHCOCON(C₁₋₆ alkyl)₂, NHCOCNH(C₁₋₆ alkyl), SH, S(C₁₋₆ alkyl), NHC(=NH)NH₂, halogen, and COO(C₁₋₆alkyl);

R^9 is H or (C₁₋₆ alkyl); and

Q is selected from the group consisting of: (C₁₋₃alkyl)CONHaryl, 6- or 10-membered aryl, biphenyl, 5- or 6-atom heterocycle having 1 to 4 heteroatoms selected from O, N and S, 9- or 10-membered heterobicycle having 1 to 4 heteroatoms selected from O, N and S;

wherein said aryl, biphenyl, heterocycle and heterobicycle are all optionally substituted with from 1 to 4 substituents selected from: OH, COOH, COO(C₁₋₆)alkyl, (C₁₋₆)alkyl, (C₁₋₆)alkylCOOH, (C₁₋₆ alkyl)(C₂₋₄ alkynyl), (C₁₋₆)alkyl-hydroxy, phenyl, benzyloxy, halogen, (C₂₋₄)alkenyl, (C₂₋₄)alkenyl-(C₁₋₆)alkyl-COOH, 5- or 6-membered second heterocycle having 1 to 4 heteroatoms selected from O, N and S, NH-5- or 6- membered second heterocycle having 1 to 4 heteroatoms selected from O, N, and S,

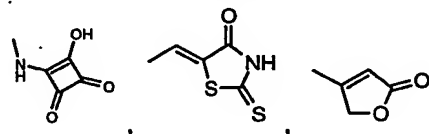
wherein said second heterocycle and phenyl being optionally substituted with from 1 to 4 substituents selected from: (C₁₋₆ alkyl), CF₃, OH, (C₁₋₆alkyl) COOH, O(C₁₋₆alkyl)COOH, (C₁₋₆alkyl) COO(C₁₋₆alkyl), CH₂phenyl, COO(C₁₋₆ alkyl), (C₁₋₆alkyl)O(C₁₋₆alkyl), COOH, NCH(C₁₋₆alkyl)₂, NCO(C₁₋₆ alkyl), NH₂, NH(C₁₋₆ alkyl), halogen, N(C₁₋₆ alkyl)₂; and C₂₋₆ alkenyl-COOH

halogen, OPO₃H, benzyl, sulfonamido, SH, SOCH₃, SO₃H, SO₂CH₃, S(C₁₋₆ alkyl)COOH, -CONH₂, -COCH₃, (C₁₋₃)alkyl, (C₂₋₄alkenyl)COOH

wherein said alkenyl is optionally substituted with from 1 to 2 (C₁₋₆ alkyl) substituents,

(C₂₋₄alkenyl)COO(C₁₋₆alkyl), tetrazolyl, COOH, triazolyl, OH, NO₂, NH₂, , -O(C₁₋₆ alkyl)COOH, hydantoin, benzoyleneurea, (C₁₋₄)alkoxy, (C₁₋₄)alkoxy(C₁₋₆ alkyl)COOH, cyano, azido, -O-(C₁₋₆)alkyl COOH, -O-(C₁₋₆)alkyl COO-(C₁₋₆)alkyl, -NHCOCOOH, -NHCOCONHOH, -NHCOCONH₂, -NHCOCONHCH₃, -NHCO(C₁₋₆)alkyl-COOH, -NHCOCONH(C₁₋₆)alkyl-COOH, -NHCO(C₃₋₇)cycloalkyl-COOH, -NHCONH(C₆₋₁₀)aryl-COOH, -NHCONH(C₆₋

₁₀)aryl-COO(C₁₋₆)alkyl, -NHCONH(C₁₋₆)alkyl-COOH, -NHCONH(C₁₋₆)alkyl-COO(C₁₋₆)alkyl, -NHCONH(C₁₋₆)alkyl-(C₂₋₆)alkenyl-COOH, -NH(C₁₋₆)alkyl-(C₆₋₁₀)aryl-O(C₁₋₆)alkyl COOH, -NH(C₁₋₆)alkyl-(C₆₋₁₀)aryl-COOH, -NHCH₂COOH, -NHCONH₂, -NHCO(C₁₋₆)hydroxyalkyl COOH, -OCO(C₁₋₆)hydroxyalkyl
 5 COOH, (C₃₋₆)cycloalkyl COOH,



, -NHCN, -NHCHO, -NHSO₂CH₃,
 -NHSO₂CF₃, coumarin, (C₁₋₆)alkyl-amino, NH(C₁₋₆alkyl)₂, C(halogen)₃,
 -NH(C₂₋₄)acyl, -NH(C₆₋₁₀)aroyl, -CONH(C₁₋₆alkyl), -CO(C₁₋₆)alkyl-COOH,
 -CONH(C₁₋₆)alkyl-COOH, -CO-NH-alanyl, -CONH(C₂₋₄)alkylN(C₁₋₆alkyl)₂,
 10 -CONH(C₂₋₄) alkyl-Het, -CONH(C₂₋₄) alkyl-(COOH)-Het, -CONH(C₁₋₂ alkyl)
 (OH)(C₁₋₂ alkyl)OH, -CONH(C₁₋₆) alkyl-COOH, -CONH(C₆₋₁₀ aryl), -CONH-Het,
 -CONH(C₆₋₁₀) aryl-COOH, -CONH(C₆₋₁₀) aryl-COO(C₁₋₆) alkyl, -CONH(C₁₋₆)
 alkyl-COO(C₁₋₆) alkyl, -CONH(C₆₋₁₀) aryl-(C₁₋₆)alkyl-COOH, and -CONH(C₆₋₁₀)
 aryl-(C₂₋₆)alkenyl-COOH;

15 or a salt thereof;

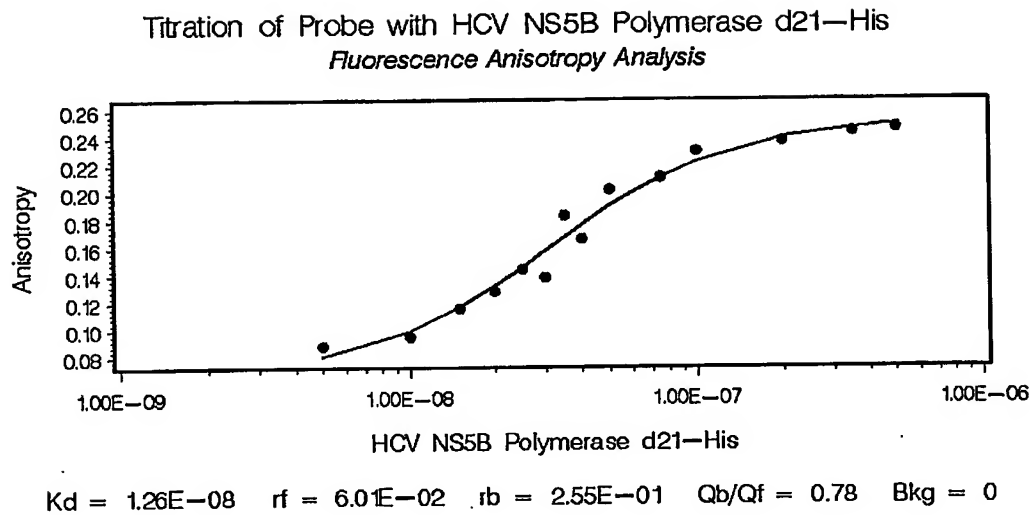
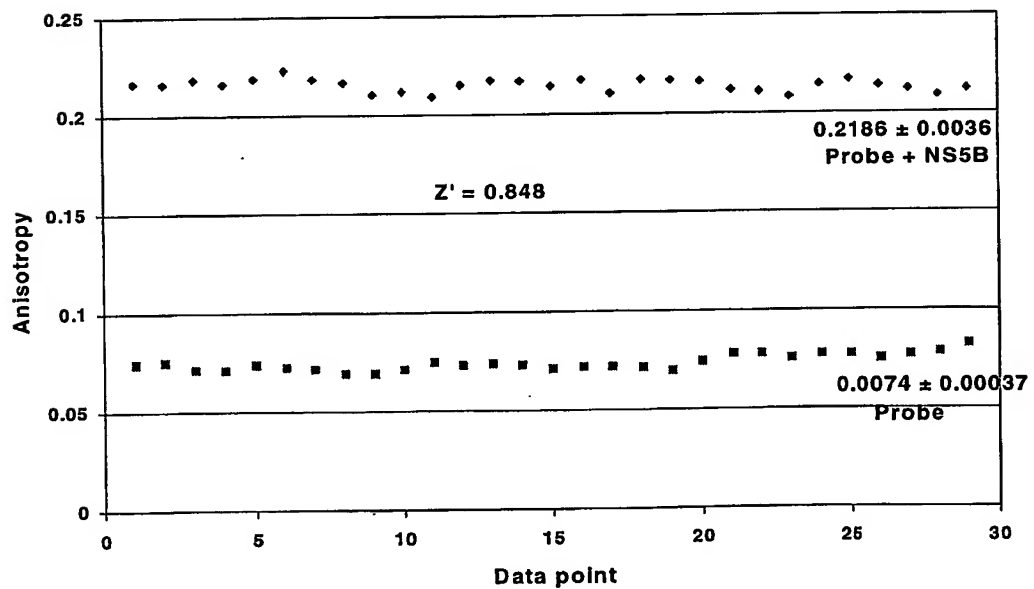
said probe comprises a detectable label, whereby said probe binds to an HCV
 polymerase or an analog thereof and is capable of being displaced by an inhibitor
 thereof.

21. A method for identifying compounds that inhibit HCV polymerase comprising
 the steps of:

- 20 a) contacting said HCV polymerase or an analog thereof with a probe of
 formula I according to claim 20, so as to form a complex having said probe
 bound to said polymerase;
 b) measuring the signal from said complex to establish a base line level;
 c) incubating the product of step a) with a test compound; and
 25 d) measuring the signal from said complex; and
 e) comparing the signal from step d) with the signal from step b);

whereby a modulation in said signal is an indication that said test compound inhibits
 said polymerase.

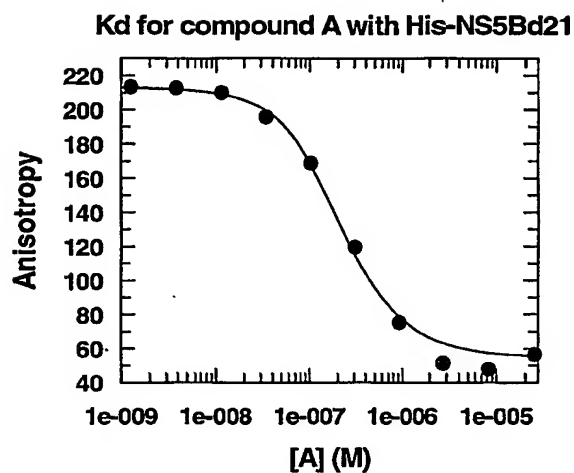
1 / 7

FIGURE 1**FIGURE 2****Z' value in the Polarization assay**

2 / 7

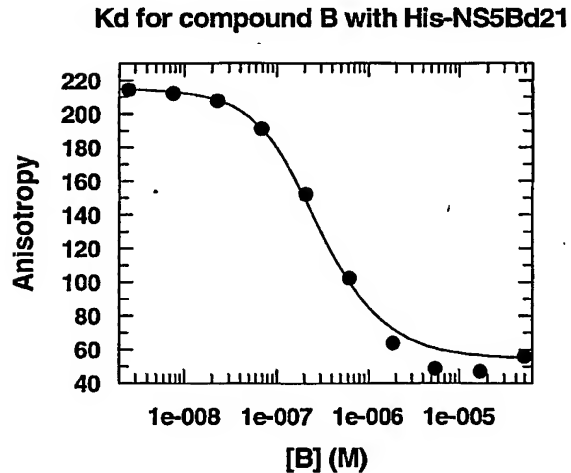
FIGURE 3

A.



Variable	Value	Std. Err.
Kd of inhibitor	3.0971e-008	5.5429e-009
Qb/Qf	6.6898e-001	6.1946e-002

B.

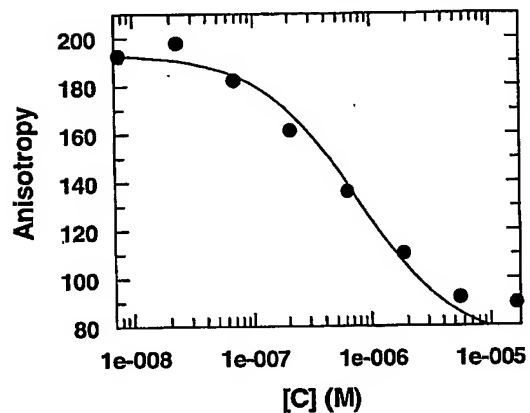


Variable	Value	Std. Err.
Kd of inhibitor	4.1498e-008	8.1777e-009
Qb/Qf	7.1835e-001	8.0672e-002

3 / 7

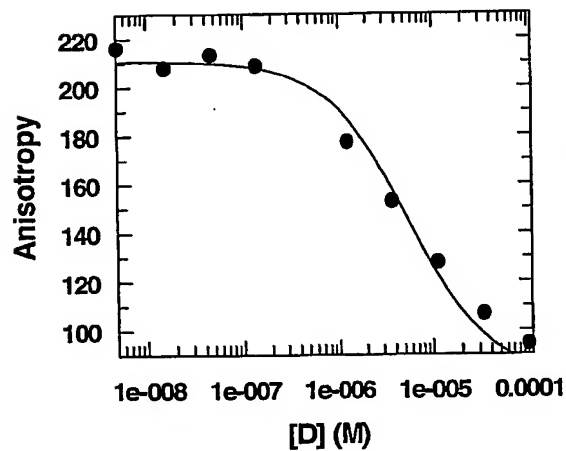
FIGURE 4

A.

K_d for compound C with NS5Bd21-His

Variable	Value	Std. Err.
Kd of inhibitor	2.3067e-007	5.8224e-008
Qb/Qf	7.4124e-001	9.1773e-002

B.

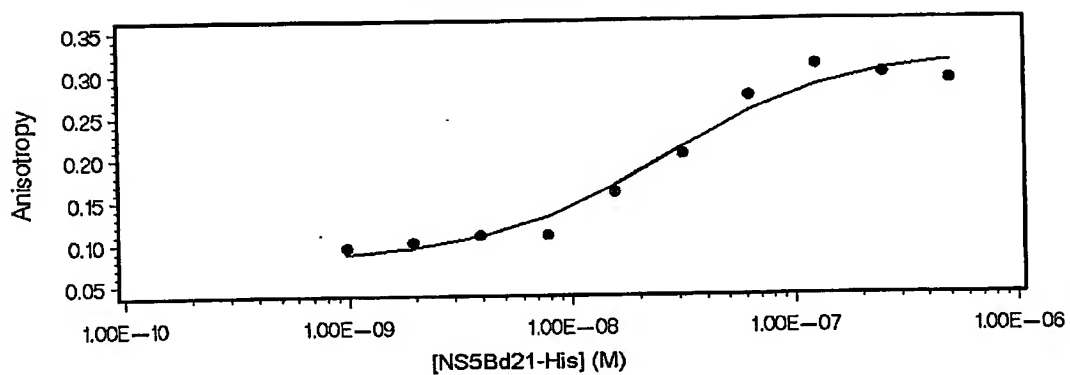
K_d for compound D with NS5Bd21-His

Variable	Value	Std. Err.
Kd of inhibitor	1.0824e-006	2.3258e-007
Qb/Qf	6.5635e-001	8.2954e-002

4 / 7

FIGURE 5

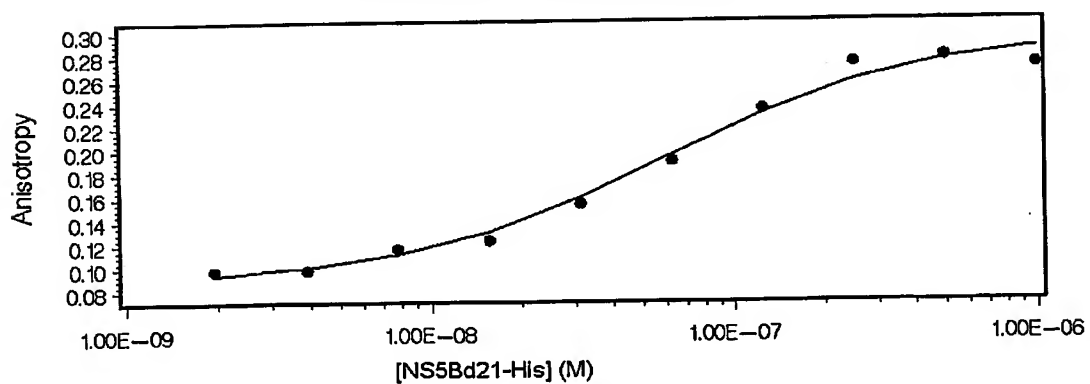
Titration of probe i with NS5Bd21-His polymerase in Tris pH 7.5 and 30 mM NaCl
Fluorescence Anisotropy Analysis



$K_d = 1.53E-08$ $r_f = 7.86E-02$ $r_b = 3.23E-01$ $Q_b/Q_f = 0.68$ $B_{kg} = 0$

FIGURE 6

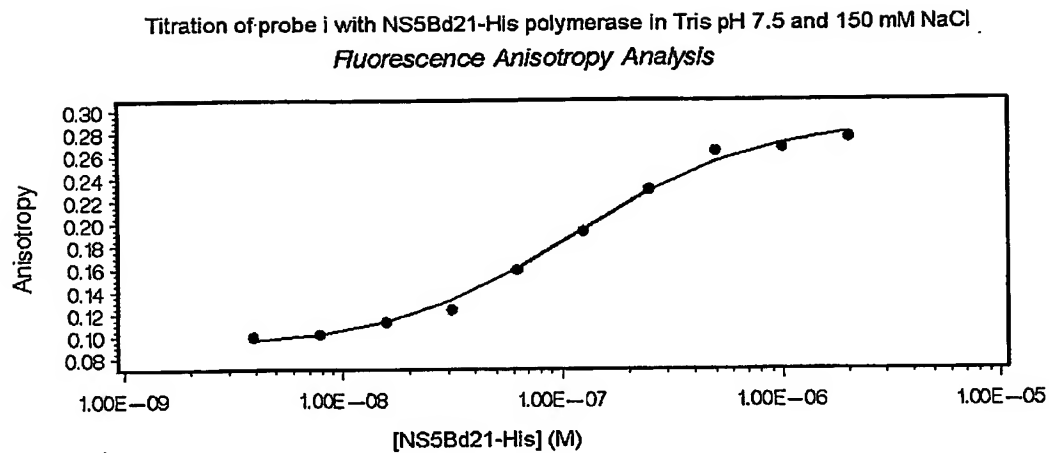
Titration of probe i with NS5Bd21-His polymerase in Tris pH 7.5 and 100 mM NaCl
Fluorescence Anisotropy Analysis



$K_d = 3.89E-08$ $r_f = 8.79E-02$ $r_b = 2.96E-01$ $Q_b/Q_f = 0.7$ $B_{kg} = 0$

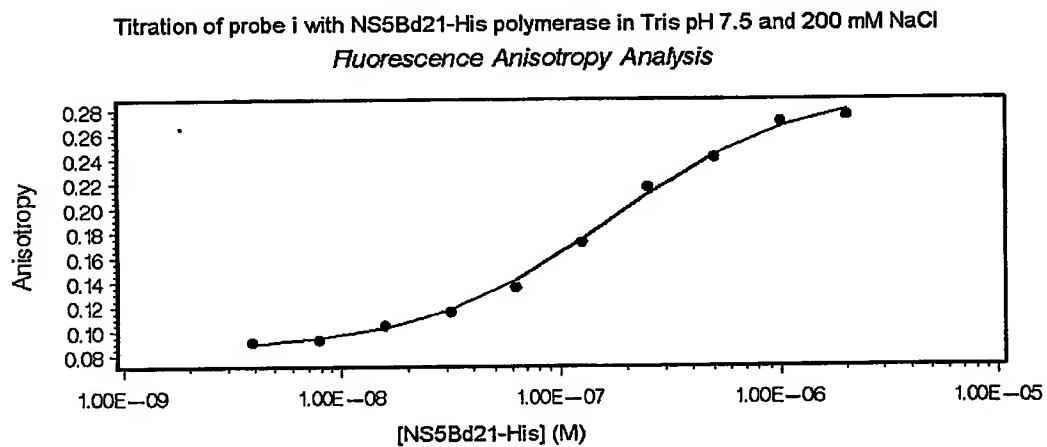
5 / 7

FIGURE 7



$K_d = 7.83E-08$ $r_f = 8.91E-02$ $r_b = 2.91E-01$ $Q_b/Q_f = 0.7$ $F_{kg} = 0$

FIGURE 8

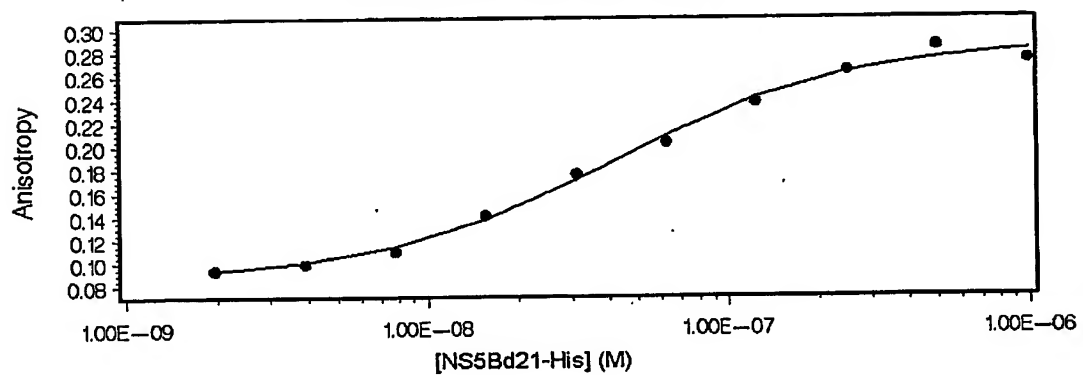


$K_d = 1.22E-07$ $r_f = 8.51E-02$ $r_b = 2.96E-01$ $Q_b/Q_f = 0.73$ $B_{kg} = 0$

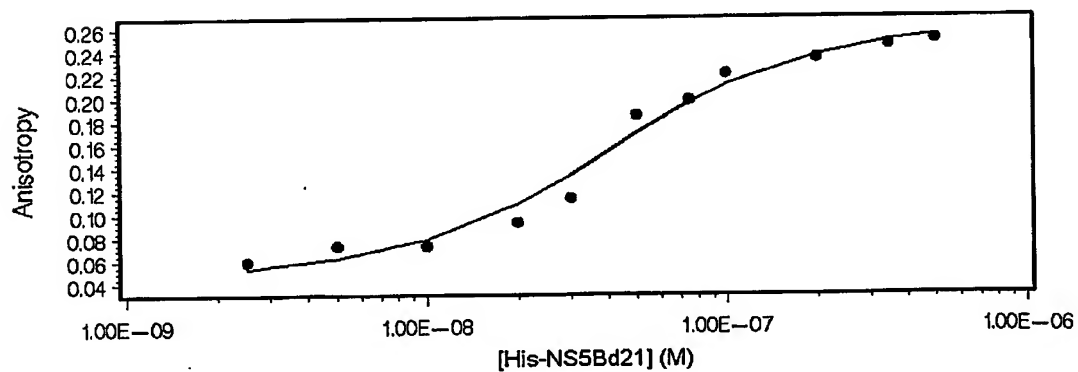
6 / 7

FIGURE 9

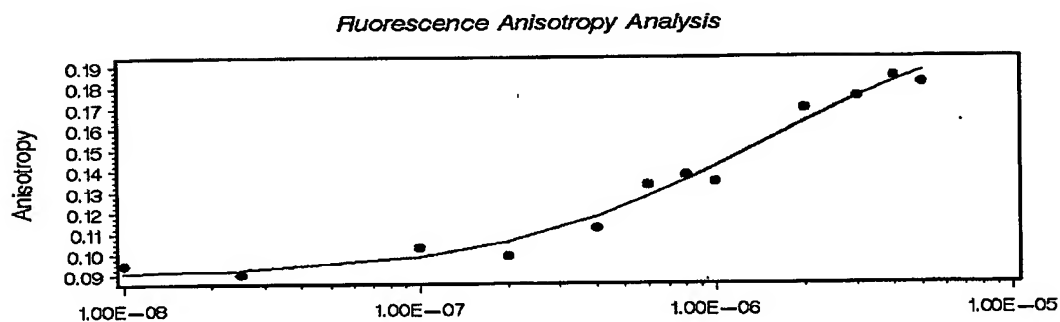
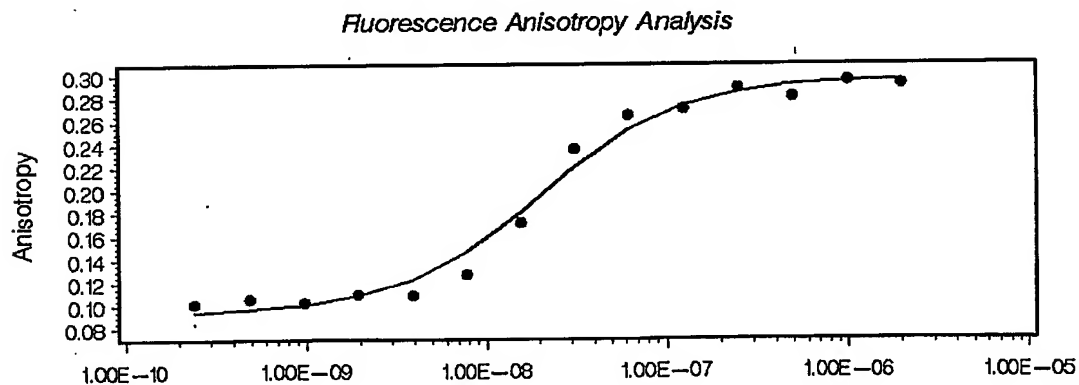
Titration of probe i with NS5Bd21-His polymerase in Phosphate buffer pH 6.5

Fluorescence Anisotropy Analysis $K_d = 3.33E-08$ $r_f = 8.55E-02$ $r_b = 2.88E-01$ $Q_b/Q_f = 0.974$ $B_{kg} = 0$ **FIGURE 10**

Titration of probe i with His-NS5Bd21

Fluorescence Anisotropy Analysis $K_d = 1.81E-08$ $r_f = 4.44E-02$ $r_b = 2.64E-01$ $Q_b/Q_f = 0.7$ $B_{kg} = 0$

7 / 7

FIGURE 11**Titration of probe ii with GBV-B polymerase****[GBV-B Δ 23-His] (M)** $K_d = 1.79E-06$ $rf = 9.03E-02$ $rb = 2.14E-01$ $Q_b/Q_f = 1.29$ $B_{kg} = 0$ **FIGURE 12****Titration of probe ii with His-NS5B Δ 21 (H77c,1a) polymerase****[His-NS5B Δ 21(H77c,1a)] (M)** $K_d = 1.82E-08$ $rf = 9.22E-02$ $rb = 2.97E-01$ $Q_b/Q_f = 1.18$ $B_{kg} = 0$

SEQUENCE LISTING

<110> Boehringer Ingelheim (Canada) Ltd.

5 <120> DIRECT BINDING ASSAY FOR IDENTIFYING
INHIBITORS OF HCV POLYMERASE

<130> 13/088

10

<150> 60/310,272

<151> 2001-08-07

<160> 4

15

<170> FastSEQ for Windows Version 4.0

<210> 1

<211> 578

20 <212> PRT

<213> HCV

<400> 1

	Ser	Met	Ser	Tyr	Thr	Trp	Thr	Gly	Ala	Leu	Ile	Thr	Pro	Cys	Ala	Ala	
25	1				5					10					15		
	Glu	Glu	Ser	Gln	Leu	Pro	Ile	Asn	Ala	Leu	Ser	Asn	Ser	Leu	Val	Arg	
				20				25						30			
	His	Arg	Asn	Met	Val	Tyr	Ser	Thr	Thr	Ser	Arg	Ser	Ala	Ala	Leu	Arg	
			35					40					45				
30	Gln	Lys	Lys	Val	Thr	Phe	Asp	Arg	Leu	Gln	Val	Leu	Asp	Asp	His	Tyr	
	50					55				60							
	Arg	Asp	Val	Leu	Lys	Glu	Met	Lys	Ala	Lys	Ala	Ser	Thr	Val	Lys	Ala	
	65				70					75					80		
	Lys	Leu	Leu	Ser	Val	Glu	Glu	Ala	Cys	Lys	Leu	Thr	Pro	Pro	His	Ser	
35				85						90					95		
	Ala	Lys	Ser	Lys	Phe	Gly	Tyr	Gly	Ala	Lys	Asp	Val	Arg	Asn	Leu	Ser	
				100					105					110			
	Ser	Lys	Ala	Val	Asp	His	Ile	Arg	Ser	Val	Trp	Lys	Asp	Leu	Leu	Glu	
			115				120						125				
40	Asp	Thr	Glu	Thr	Pro	Ile	Asp	Thr	Thr	Ile	Met	Ala	Lys	Asn	Glu	Val	
	130						135						140				

2.

Phe Cys Val Gln Pro Glu Lys Gly Gly Arg Lys Pro Ala Arg Leu Ile
 145 150 155 160
 Val Phe Pro Asp Leu Gly Val Arg Val Cys Glu Lys Met Ala Leu Tyr
 165 170 175
 5 Asp Val Val Ser Thr Leu Pro Gln Ala Val Met Gly Ser Ser Tyr Gly
 180 185 190
 Phe Gln Tyr Ser Pro Lys Gln Arg Val Glu Phe Leu Val Asn Ala Trp
 195 200 205
 Lys Ser Lys Lys Cys Pro Met Gly Phe Ser Tyr Asp Thr Arg Cys Phe
 10 210 215 220
 Asp Ser Thr Val Thr Glu Ser Asp Ile Arg Val Glu Glu Ser Ile Tyr
 225 230 235 240
 Gln Cys Cys Asp Leu Ala Pro Glu Ala Arg Gln Ala Ile Lys Ser Leu
 245 250 255
 15 Thr Glu Arg Leu Tyr Ile Gly Gly Pro Leu Thr Asn Ser Lys Gly Gln
 260 265 270
 Asn Cys Gly Tyr Arg Arg Cys Arg Ala Ser Gly Val Leu Thr Thr Ser
 275 280 285
 Cys Gly Asn Thr Leu Thr Cys Tyr Leu Lys Ala Ser Ala Ala Cys Arg
 20 290 295 300
 Ala Ala Lys Leu Gln Asp Cys Thr Met Leu Val Asn Gly Asp Asp Leu
 305 310 315 320
 Val Val Ile Cys Glu Ser Ala Gly Thr Gln Glu Asp Ala Ala Asn Leu
 325 330 335
 25 Arg Val Phe Thr Glu Ala Met Thr Arg Tyr Ser Ala Pro Pro Gly Asp
 340 345 350
 Leu Pro Gln Pro Glu Tyr Asp Leu Glu Leu Ile Thr Ser Cys Ser Ser
 355 360 365
 Asn Val Ser Val Ala His Asp Ala Ser Gly Lys Arg Val Tyr Tyr Leu
 30 370 375 380
 Thr Arg Asp Pro Thr Thr Pro Leu Ala Arg Ala Ala Trp Glu Thr Ala
 385 390 395 400
 Arg His Thr Pro Ile Asn Ser Trp Leu Gly Asn Ile Ile Met Tyr Ala
 405 410 415
 35 Pro Thr Leu Trp Ala Arg Met Val Leu Met Thr His Phe Phe Ser Ile
 420 425 430
 Leu Leu Ala Gln Glu Gln Leu Glu Lys Ala Leu Asp Cys Gln Ile Tyr
 435 440 445
 Gly Ala Cys Tyr Ser Ile Glu Pro Leu Asp Leu Pro Gln Ile Ile Glu
 40 450 455 460

3

Arg Leu His Gly Leu Ser Ala Phe Ser Leu His Ser Tyr Ser Pro Gly
 465 470 475 480
 Glu Ile Asn Arg Val Ala Ser Cys Leu Arg Lys Leu Gly Val Pro Pro
 485 490 495
 5 Leu Arg Val Trp Arg His Arg Ala Arg Ser Val Arg Ala Lys Leu Leu
 500 505 510
 Ser Gln Gly Gly Arg Ala Ala Thr Cys Gly Lys Tyr Leu Phe Asn Trp
 515 520 525
 Ala Val Arg Thr Lys Leu Lys Leu Thr Pro Ile Pro Ala Ala Ser Arg
 10 530 535 540
 Leu Asp Leu Ser Gly Trp Phe Val Ala Gly Tyr Asn Gly Gly Asp Ile
 545 550 555 560
 Tyr His Ser Leu Ser Arg Ala Arg Pro Arg Leu Glu His His His His
 565 570 575
 15 His His

<210> 2
 20 <211> 591
 <212> PRT
 <213> HCV

<400> 2
 25 Met Gly Ser Ser His His His His His His Ser Ser Gly Leu Val Pro
 1 5 10 15
 Arg Gly Ser His Met Ser Met Ser Tyr Thr Trp Thr Gly Ala Leu Ile
 20 25 30
 Thr Pro Cys Ala Ala Glu Glu Ser Gln Leu Pro Ile Asn Ala Leu Ser
 30 35 40 45
 Asn Ser Leu Val Arg His Arg Asn Met Val Tyr Ser Thr Thr Ser Arg
 50 55 60
 Ser Ala Ala Leu Arg Gln Lys Lys Val Thr Phe Asp Arg Leu Gln Val
 65 70 75 80
 35 Leu Asp Asp His Tyr Arg Asp Val Leu Lys Glu Met Lys Ala Lys Ala
 85 90 95
 Ser Thr Val Lys Ala Lys Leu Leu Ser Val Glu Glu Ala Cys Lys Leu
 100 105 110
 Thr Pro Pro His Ser Ala Lys Ser Lys Phe Gly Tyr Gly Ala Lys Asp
 40 115 120 125

4

Val Arg Asn Leu Ser Ser Lys Ala Val Asp His Ile Arg Ser Val Trp
 130 135 140
 Lys Asp Leu Leu Glu Asp Thr Glu Thr Pro Ile Asp Thr Thr Ile Met
 145 150 155 160
 5 Ala Lys Asn Glu Val Phe Cys Val Gln Pro Glu Lys Gly Gly Arg Lys
 165 170 175
 Pro Ala Arg Leu Ile Val Phe Pro Asp Leu Gly Val Arg Val Cys Glu
 180 185 190
 Lys Met Ala Leu Tyr Asp Val Val Ser Thr Leu Pro Gln Ala Val Met
 10 195 200 205
 Gly Ser Ser Tyr Gly Phe Gln Tyr Ser Pro Lys Gln Arg Val Glu Phe
 210 215 220
 Leu Val Asn Ala Trp Lys Ser Lys Lys Cys Pro Met Gly Phe Ser Tyr
 225 230 235 240
 15 Asp Thr Arg Cys Phe Asp Ser Thr Val Thr Glu Ser Asp Ile Arg Val
 245 250 255
 Glu Glu Ser Ile Tyr Gln Cys Cys Asp Leu Ala Pro Glu Ala Arg Gln
 260 265 270
 Ala Ile Lys Ser Leu Thr Glu Arg Leu Tyr Ile Gly Gly Pro Leu Thr
 20 275 280 285
 Asn Ser Lys Gly Gln Asn Cys Gly Tyr Arg Arg Cys Arg Ala Ser Gly
 290 295 300
 Val Leu Thr Thr Ser Cys Gly Asn Thr Leu Thr Cys Tyr Leu Lys Ala
 305 310 315 320
 25 Ser Ala Ala Cys Arg Ala Ala Lys Leu Gln Asp Cys Thr Met Leu Val
 325 330 335
 Asn Gly Asp Asp Leu Val Val Ile Cys Glu Ser Ala Gly Thr Gln Glu
 340 345 350
 Asp Ala Ala Asn Leu Arg Val Phe Thr Glu Ala Met Thr Arg Tyr Ser
 30 355 360 365
 Ala Pro Pro Gly Asp Leu Pro Gln Pro Glu Tyr Asp Leu Glu Leu Ile
 370 375 380
 Thr Ser Cys Ser Ser Asn Val Ser Val Ala His Asp Ala Ser Gly Lys
 385 390 395 400
 35 Arg Val Tyr Tyr Leu Thr Arg Asp Pro Thr Thr Pro Leu Ala Arg Ala
 405 410 415
 Ala Trp Glu Thr Ala Arg His Thr Pro Ile Asn Ser Trp Leu Gly Asn
 420 425 430
 Ile Ile Met Tyr Ala Pro Thr Leu Trp Ala Arg Met Val Leu Met Thr
 40 435 440 445

5

His Phe Phe Ser Ile Leu Leu Ala Gln Glu Gln Leu Glu Lys Ala Leu
 450 455 460
 Asp Cys Gln Ile Tyr Gly Ala Cys Tyr Ser Ile Glu Pro Leu Asp Leu
 465 470 475 480
 5 Pro Gln Ile Ile Glu Arg Leu His Gly Leu Ser Ala Phe Ser Leu His
 485 490 495
 Ser Tyr Ser Pro Gly Glu Ile Asn Arg Val Ala Ser Cys Leu Arg Lys
 500 505 510
 Leu Gly Val Pro Pro Leu Arg Val Trp Arg His Arg Ala Arg Ser Val
 10 515 520 525
 Arg Ala Lys Leu Leu Ser Gln Gly Gly Arg Ala Ala Thr Cys Gly Lys
 530 535 540
 Tyr Leu Phe Asn Trp Ala Val Arg Thr Lys Leu Lys Leu Thr Pro Ile
 545 550 555 560
 15 Pro Ala Ala Ser Arg Leu Asp Leu Ser Gly Trp Phe Val Ala Gly Tyr
 565 570 575
 Asn Gly Gly Asp Ile Tyr His Ser Leu Ser Arg Ala Arg Pro Arg
 580 585 590
 20
 <210> 3
 <211> 576
 <212> PRT
 <213> HCV
 25
 <400> 3
 Met Ser Met Ser Tyr Thr Trp Thr Asp Val Ile Ser Phe Lys Thr Ala
 1 5 10 15
 Ser Lys Val Leu Ser Ala Thr Arg Ala Ile Thr Ser Gly Phe Leu Lys
 30 20 25 30
 Gln Arg Ser Leu Val Tyr Val Thr Glu Pro Arg Asp Ala Glu Leu Arg
 35 40 45
 Lys Gln Lys Val Thr Ile Asn Arg Gln Pro Leu Phe Pro Pro Ser Tyr
 50 55 60
 35 His Lys Gln Val Arg Leu Ala Lys Glu Lys Ala Ser Lys Val Val Gly
 65 70 75 80
 Val Met Trp Asp Tyr Asp Glu Val Ala Ala His Thr Pro Ser Lys Ser
 85 90 95
 Ala Lys Ser His Ile Thr Gly Leu Arg Gly Thr Asp Val Arg Ser Gly
 40 100 105 110

6.

	Ala	Ala	Arg	Lys	Ala	Val	Leu	Asp	Leu	Gln	Lys	Cys	Val	Glu	Ala	Gly	
				115				120					125				
	Glu	Ile	Pro	Ser	His	Tyr	Arg	Gln	Thr	Val	Ile	Val	Pro	Lys	Glu	Glu	
				130				135					140				
5	Val	Phe	Val	Lys	Thr	Pro	Gln	Lys	Pro	Thr	Lys	Lys	Pro	Pro	Arg	Leu	
				145				150					155			160	
	Ile	Ser	Tyr	Pro	His	Leu	Glu	Met	Arg	Cys	Val	Glu	Lys	Met	Tyr	Tyr	
					165					170						175	
	Gly	Gln	Val	Ala	Pro	Asp	Val	Val	Lys	Ala	Val	Met	Gly	Asp	Ala	Tyr	
10				180						185					190		
	Gly	Phe	Val	Asp	Pro	Arg	Thr	Arg	Val	Lys	Arg	Leu	Leu	Ser	Met	Trp	
				195						200					205		
	Ser	Pro	Asp	Ala	Val	Gly	Ala	Thr	Cys	Asp	Thr	Val	Cys	Phe	Asp	Ser	
				210				215					220				
15	Thr	Ile	Thr	Pro	Glu	Asp	Ile	Met	Val	Glu	Thr	Asp	Ile	Tyr	Ser	Ala	
					225			230				235				240	
	Ala	Lys	Leu	Ser	Asp	Gln	His	Arg	Ala	Gly	Ile	His	Thr	Ile	Ala	Arg	
					245					250						255	
	Gln	Leu	Tyr	Ala	Gly	Gly	Pro	Met	Ile	Ala	Tyr	Asp	Gly	Arg	Glu	Ile	
20				260						265					270		
	Gly	Tyr	Arg	Arg	Cys	Arg	Ser	Ser	Gly	Val	Tyr	Thr	Thr	Ser	Ser	Ser	
				275						280					285		
	Asn	Ser	Leu	Thr	Cys	Trp	Leu	Lys	Val	Asn	Ala	Ala	Ala	Glu	Gln	Ala	
				290						295				300			
25	Gly	Met	Lys	Asn	Pro	Arg	Phe	Leu	Ile	Cys	Gly	Asp	Asp	Cys	Thr	Val	
					305			310				315				320	
	Ile	Trp	Lys	Ser	Ala	Gly	Ala	Asp	Ala	Asp	Lys	Gln	Ala	Met	Arg	Val	
					325					330					335		
	Phe	Ala	Ser	Trp	Met	Lys	Val	Met	Gly	Ala	Pro	Gln	Asp	Cys	Val	Pro	
30				340						345					350		
	Gln	Pro	Lys	Tyr	Ser	Leu	Glu	Glu	Leu	Thr	Ser	Cys	Ser	Ser	Asn	Val	
				355						360				365			
	Thr	Ser	Gly	Ile	Thr	Lys	Ser	Gly	Lys	Pro	Tyr	Tyr	Phe	Leu	Thr	Arg	
				370				375					380				
35	Asp	Pro	Arg	Ile	Pro	Leu	Gly	Arg	Cys	Ser	Ala	Glu	Gly	Leu	Gly	Tyr	
					385			390				395				400	
	Asn	Pro	Ser	Ala	Ala	Trp	Ile	Gly	Tyr	Leu	Ile	His	His	Tyr	Pro	Cys	
					405					410					415		
	Leu	Trp	Val	Ser	Arg	Val	Leu	Ala	Val	His	Phe	Met	Glu	Gln	Met	Leu	
40				420						425					430		

7

Phe Glu Asp Lys Leu Pro Glu Thr Val Thr Phe Asp Trp Tyr Gly Lys
 435 440 445
 Asn Tyr Thr Val Pro Val Glu Asp Leu Pro Ser Ile Ile Ala Gly Val
 450 455 460
 5 His Gly Ile Glu Ala Phe Ser Val Val Arg Tyr Thr Asn Ala Glu Ile
 465 470 475 480
 Leu Arg Val Ser Gln Ser Leu Thr Asp Met Thr Met Pro Pro Leu Arg
 485 490 495
 Ala Trp Arg Lys Lys Ala Arg Ala Val Leu Ala Ser Ala Lys Arg Arg
 10 500 505 510
 Gly Gly Ala His Ala Lys Leu Ala Arg Phe Leu Leu Trp His Ala Thr
 515 520 525
 Ser Arg Pro Leu Pro Asp Leu Asp Lys Thr Ser Val Ala Arg Tyr Thr
 530 535 540
 15 Thr Phe Asn Tyr Cys Asp Val Tyr Ser Pro Glu Gly Asp Val Phe Val
 545 550 555 560
 Thr Pro Gln Arg Arg Leu Gln Lys Leu Glu His His His His His His
 565 570 575

 20
 <210> 4
 <211> 591
 <212> PRT
 <213> HCV

 25
 <400> 4
 Met Gly Ser Ser His His His His His Ser Ser Gly Leu Val Pro
 1 5 10 15
 Arg Gly Ser His Met Ser Met Ser Tyr Thr Trp Thr Gly Ala Leu Ile
 30 20 25 30
 Thr Pro Cys Ala Ala Glu Glu Ser Gln Leu Pro Ile Asn Ala Leu Ser
 35 40 45
 Asn Ser Leu Val Arg His Arg Asn Met Val Tyr Ser Thr Thr Ser Arg
 50 55 60
 35 Ser Ala Ala Leu Arg Gln Lys Lys Val Thr Phe Asp Arg Leu Gln Val
 65 70 75 80
 Leu Asp Asp His Tyr Arg Asp Val Leu Lys Glu Met Lys Ala Lys Ala
 85 90 95
 Ser Thr Val Lys Ala Lys Leu Leu Ser Val Glu Glu Ala Cys Lys Leu
 40 100 105 110

	Thr	Pro	His	Ser	Ala	Lys	Ser	Lys	Phe	Gly	Tyr	Gly	Ala	Lys	Asp
			115					120					125		
	Val	Arg	Asn	Leu	Ser	Ser	Lys	Ala	Val	Asp	His	Ile	Arg	Ser	Val
			130				135					140			
5	Lys	Asp	Leu	Leu	Glu	Asp	Thr	Glu	Thr	Pro	Ile	Asp	Thr	Thr	Ile
							150					155			Met
	Ala	Lys	Asn	Glu	Val	Phe	Cys	Val	Gln	Pro	Glu	Lys	Gly	Gly	Arg
					165					170					Lys
	Pro	Ala	Arg	Leu	Ile	Val	Phe	Pro	Asp	Leu	Gly	Val	Arg	Val	Cys
10				180					185					190	Glu
	Lys	Met	Ala	Leu	Tyr	Asp	Val	Val	Ser	Thr	Leu	Pro	Gln	Ala	Val
								200					205		Met
	Gly	Ser	Ser	Tyr	Gly	Phe	Gln	Tyr	Ser	Pro	Lys	Gln	Arg	Val	Glu
							215					220			Phe
15	Leu	Val	Asn	Ala	Trp	Lys	Ser	Lys	Lys	Cys	Pro	Met	Gly	Phe	Ser
							230					235			Tyr
	Asp	Thr	Arg	Cys	Phe	Asp	Ser	Thr	Val	Thr	Glu	Ser	Asp	Ile	Arg
										250					Val
	Glu	Glu	Ser	Ile	Tyr	Gln	Cys	Cys	Asp	Leu	Ala	Pro	Glu	Ala	Arg
20				260					265					270	Gln
	Ala	Ile	Lys	Ser	Leu	Thr	Glu	Arg	Leu	Tyr	Ile	Gly	Gly	Pro	Leu
								280					285		Thr
	Asn	Ser	Lys	Gly	Gln	Asn	Cys	Gly	Tyr	Arg	Arg	Cys	Arg	Ala	Ser
								295					300		Gly
25	Val	Leu	Thr	Thr	Ser	Cys	Gly	Asn	Thr	Leu	Thr	Cys	Tyr	Leu	Lys
							310					315			Ala
	Ser	Ala	Ala	Cys	Arg	Ala	Ala	Lys	Leu	Gln	Asp	Cys	Thr	Met	Leu
										330					Val
	Asn	Gly	Asp	Asp	Leu	Val	Val	Ile	Cys	Glu	Ser	Ala	Gly	Thr	Gln
30				340					345					350	Glu
	Asp	Ala	Ala	Asn	Leu	Arg	Val	Phe	Thr	Glu	Ala	Met	Thr	Arg	Tyr
									360				365		Ser
	Ala	Pro	Pro	Gly	Asp	Leu	Pro	Gln	Pro	Glu	Tyr	Asp	Leu	Glu	Leu
								375				380			Ile
35	Thr	Ser	Cys	Ser	Ser	Asn	Val	Ser	Val	Ala	His	Asp	Ala	Ser	Gly
							390					395			Lys
	Arg	Val	Tyr	Tyr	Leu	Thr	Arg	Asp	Pro	Thr	Thr	Pro	Leu	Ala	Arg
										410					Ala
	Ala	Trp	Glu	Thr	Ala	Arg	His	Thr	Pro	Ile	Asn	Ser	Trp	Leu	Gly
40				420					425					430	Asn

9

	Ile	Ile	Met	Tyr	Ala	Pro	Thr	Leu	Trp	Ala	Arg	Met	Val	Leu	Met	Thr
			435					440					445			
	His	Phe	Phe	Ser	Ile	Leu	Leu	Ala	Gln	Glu	Gln	Leu	Glu	Lys	Ala	Leu
			450				455					460				
5	Asp	Cys	Gln	Ile	Tyr	Gly	Ala	Cys	Tyr	Ser	Ile	Glu	Pro	Leu	Asp	Leu
	465					470					475				480	
	Pro	Gln	Ile	Ile	Glu	Arg	Leu	His	Gly	Leu	Ser	Ala	Phe	Ser	Leu	His
					485					490					495	
	Ser	Tyr	Ser	Pro	Gly	Glu	Ile	Asn	Arg	Val	Ala	Ser	Cys	Leu	Arg	Lys
10				500					505					510		
	Leu	Gly	Val	Pro	Pro	Leu	Arg	Val	Trp	Arg	His	Arg	Ala	Arg	Ser	Val
			515					520					525			
	Arg	Ala	Lys	Leu	Leu	Ser	Gln	Gly	Gly	Arg	Ala	Ala	Thr	Cys	Gly	Lys
		530					535					540				
15	Tyr	Leu	Phe	Asn	Trp	Ala	Val	Arg	Thr	Lys	Leu	Lys	Leu	Thr	Pro	Ile
	545					550					555					560
	Pro	Ala	Ala	Ser	Arg	Leu	Asp	Leu	Ser	Gly	Trp	Phe	Val	Ala	Gly	Tyr
					565					570					575	
	Asn	Gly	Gly	Asp	Ile	Tyr	His	Ser	Leu	Ser	Arg	Ala	Arg	Pro	Arg	
20				580					585					590		